ISSUE 201 NOVEMBER 2010

Better Homes and Gardens®

WOOD®

FULL-SIZE PATTERNS INSIDE

The World's Leading Woodworking Resource

Easy, Heirloom Shop Tool Chest p.50

If you can build a box, you can make this project!

More Great Projects

- Super-Simple Book Nook p.34
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Squaring Secrets for Project Glue-ups p.22

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Mortise-and-Tenon Methods For the Tools You Own p.60

Put the Kibosh on Router Tear-out p.30

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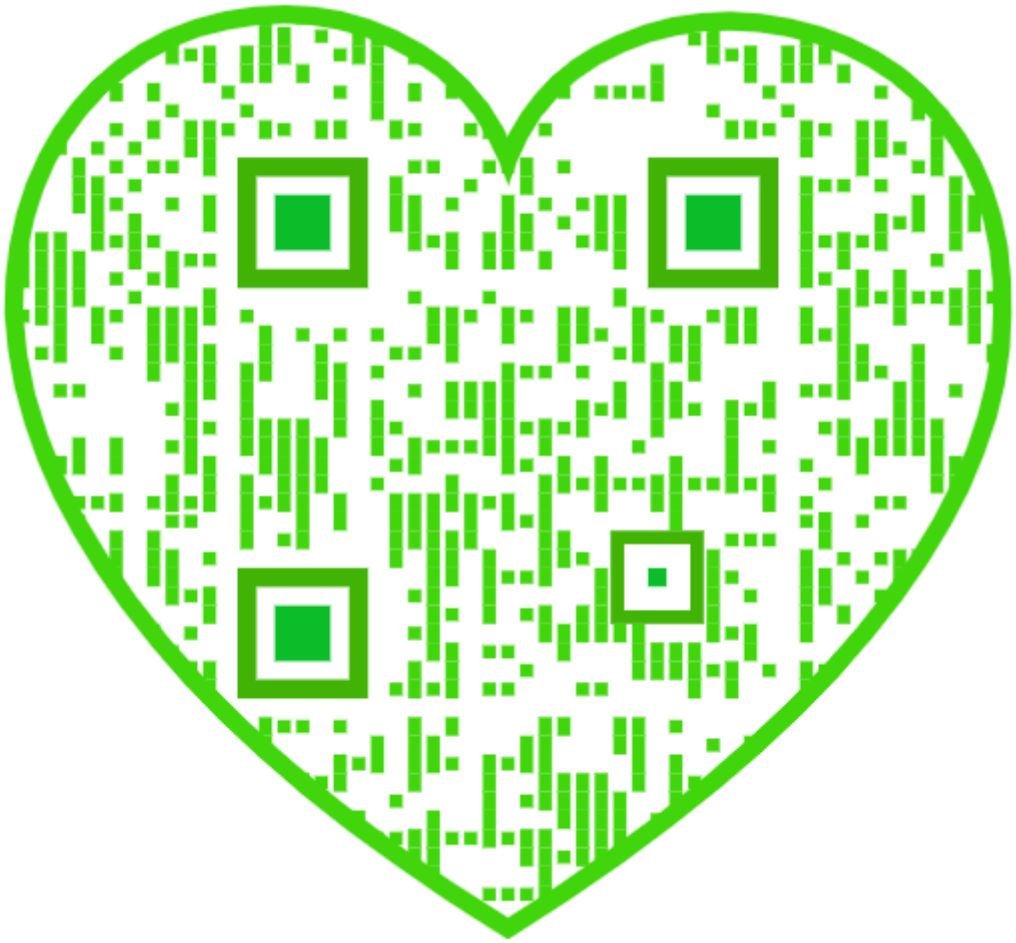

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- Motor: 3 HP, 220V, single-phase, 3450 RPM
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- Arbor: 5/8" • Max. dado width: 7/8"
- Cutting capacity: 8" L, 26" R
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- Approx. shipping weight: 514 lbs.

New!

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12" Left-Tilting Extreme Series® Table Saw with Riving Knife Feature

- Motor: 5 HP, 220V, single-phase
- Table size with extension: 30 3/4" x 48 3/8"
- Arbor speed: 3600 RPM
- Arbor: 5/8" & 1"
- Max. dado width: 3/4"
- Max. rip capacity: 36"
- Max. depth of cut: 4" @ 90°, 2 3/4" @ 45°
- Approx. shipping weight: 756 lbs.

FEATURES DIGITAL BEVEL ANGLE READOUT

INCLUDES 12" BLADE

EXTREME SERIES

G0696X $1995.00
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20" Planers

- Motor: 5 HP, 220V, single-phase
- Table size: 20" x 25 3/4" (20" x 55 1/2" with extension)
- Max. stock thickness: 8"
- Min. stock thickness: 3/16"
- Min. stock length: 7 1/2"
- Max. cutting depth: 1/8"
- Cutterhead speed: 5000 RPM
- Feed rate: 16 & 20 FPM
- Approx. shipping weight: 920 lbs.

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G0454 $1495.00
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G0454Z WITH SPIRAL CUTTERHEAD
$2295.00 SALE $2195.00

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6" Jointers with Mobile Base

- Motor: 1 HP, 110V or 1 1/2 HP, 110V/220V, single-phase
- Precision ground cast iron table size: 7 1/2" x 46"
- Max. depth of cut: 1/8"
- Rabbeting capacity: 1/2"
- Cutterhead diameter: 2 1/2"
- Cutterhead speed: 4800 RPM
- Approx. shipping weight: 270 lbs.

FREE SAFETY PUSH BLOCKS

RACK & PINNION FENCE ADJUSTMENT

BUILT IN MOBILE BASE

G0452 1 HP MOTOR $425.00
SALE $395.00

G0452Z 1 1/2 HP WITH SPIRAL CUTTERHEAD
$675.00 SALE $650.00

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8" x 76" Parallelogram Jointers

- Motor: 3 HP, 220V, single-phase, TEFC, 3450 RPM
- Precision ground cast iron table size: 8" x 76 3/8"
- Cutterhead speed: 5350 RPM • Cutterhead dia.: 3 3/16"
- Deluxe cast iron fence: 36"L x 1 1/4"W x 5"H
- Max. rabbeting depth: 1/2"
- Approx. shipping weight: 597 lbs.

G0490X SPIRAL CUTTERHEAD

BUILT IN MOBILE BASE

FREE SAFETY PUSH BLOCKS

G0490 $895.00 SALE $825.00

G0490X WITH SPIRAL CUTTERHEAD
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12" x 83 1/2" Parallelogram Jointers

- Motor: 3 HP, 220V, single-phase
- Precision ground cast iron table size: 12 3/4" x 83 1/2"
- Cutterhead speed: 4950 RPM
- Max.depth of cut: 1/8"
- Max. rabbeting capacity: 3/4"
- Approx. shipping weight: 1059 lbs.

PEDESTAL MOUNTED MAGNETIC SAFETY SWITCH

HANDLES FOLD IN FOR ADDED SAFETY

FREE SAFETY PUSH BLOCKS

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12" Baby Drum Sander

- Sanding motor: 1 1/2 HP, 110V, single-phase
- Conveyor motor: 1/8 HP, 110V, single-phase, variable speed 5-35 FPM
- Drum surface speed: 2127 FPM
- Max. stock dimensions: 12" wide x 3 1/2" thick
- Min. stock length: 8"
- Sanding drum: 4"
- Sanding belt: 3" hook & loop
- Dust collection port: 2 1/2"
- Approx. shipping weight: 160 lbs.

G0459 $695.00
SALE $525.00

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17" Heavy-Duty Extreme Series® Bandsaw with Cast Iron Wheels & Trunnion

MADE IN ISO 9001 FACTORY!

- Motor: 2 HP, 110V/220V, single-phase, TEFC
- Precision ground cast iron table size: 23 5/8" x 17 1/4"
- Table tilt: 5° left, 45° right
- Max. cutting height: 12"
- Blade size: 131 1/2"L (1/8" - 1"W)
- 2 blade speeds: 1700 & 3500 FPM
- Approx. shipping weight: 418 lbs.

Product Reviews & Awards ONLINE grizzly.com

EXTREME SERIES

DELUXE RESAW FENCE & MITER GAUGE

G0513X2 $995.00
SALE $895.00

$89 Shipping ANYWHERE IN LOWER 48 STATES

19" Heavy-Duty Extreme Series® Bandsaw

- Motor: 3 HP, 220V, single-phase, TEFC, 1725 RPM
- Precision ground cast iron table size: 26 3/4" x 19"
- Table tilt: 5° L, 45° R
- Max. cutting height: 12"
- Cutting capacity/throat: 18 1/4"
- Blade size: 143" L(1/8" - 1 1/4" W)
- Blade speeds: 1700 & 3500 FPM
- Approx. shipping weight: 480 lbs.

GEARED TABLE TILT MECHANISM

HEAVY-DUTY CAST IRON FENCE & CAST IRON TABLE TRUNNIONS!

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10" Cabinet Table Saws with Riving Knife

- Motor: 3 HP, 220V, single-phase
- Table size with extension:
  G0690 -27" x 40"
  G0691 - 27" x 74¾"
- Blade tilt: left
- Arbor: ⅝"
- Arbor speed: 4300 RPM
- Max. dado width: 13/16"
- Max. rip capacity:
  G0690 - 29½", G0691 - 50"
- Max. depth of cut:
  3⅛" @ 90°, 2 3/16" @ 45°
- Approx. shipping weight:
  G0690-542 lbs. G0691-572 lbs.

3 HP LEESON® MOTOR!

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CAST IRON TRUNNIONS

FREE 10" CARBIDE TIPPED BLADE!

G0690 ~~$1250.00~~
SALE $1150.00 $139 Shipping ANYWHERE IN LOWER 48 STATES

G0691 WITH EXTENSION RAILS ~~$1350.00~~
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Sliding Table & Router Attachments
For G0690 & G0691 Table Saws

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SUPERB QUALITY!

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SAW NOT INCLUDED

ROUTER TABLE ATTACHMENT
T10222 ~~$395.00~~
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SLIDING TABLE ATTACHMENT
T10223 ~~$550.00~~
SALE $525.00

Cyclone Dust Collector

- Motor: 1½ HP, 110V/220V, single phase, TEFC, 3450 RPM, prewired 110V
- Air suction capacity: 775 CFM
- Static pressure at rated CFM: 1.08"
- Intake port: 6" with included 5" optional port
- Impeller: 13½"
- Cartridge filter surface area: 6975 sq. in.
- Overall dimensions:
  38¼" W x 23¼" D x 68½" H
- Approx. shipping weight: 210 lbs.

New!

COLLECTION DRUM IS MOUNTED ON CASTERS FOR EASY DUST REMOVAL

THE POWER OF A 2 STAGE CYCLONE IN A NEW COMPACT SIZE!

G0703 ~~$850.00~~ **SALE $795.00** $69 Shipping ANYWHERE IN LOWER 48 STATES

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12" BABY DRUM SANDER
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New!

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BOTH MODELS HAVE BUILT-IN MOBILE BASE

New!

G0555P
ULTIMATE 14" BANDSAW
INTRODUCTORY PRICE
$398.00 $69 Shipping ANYWHERE IN LOWER 48 STATES

New!

G1035P
1½ HP SHAPER
INTRODUCTORY PRICE
$498.00 $69 Shipping ANYWHERE IN LOWER 48 STATES
(SHOWN WITH OPTIONAL WING)

New!

G0513P
17" HEAVY-DUTY BANDSAW
INTRODUCTORY PRICE
$89 Shipping ANYWHERE IN LOWER 48 STATES
$698.00

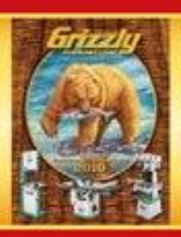
New!

G0656P
8" JOINTER
INTRODUCTORY PRICE
$728.00 $139 Shipping ANYWHERE IN LOWER 48 STATES

G0656PX
8" JOINTER WITH SPIRAL CUTTERHEAD
INTRODUCTORY PRICE
$998.00 $139 Shipping ANYWHERE IN LOWER 48 STATES

BOTH MODELS HAVE BUILT-IN MOBILE BASE

MORE DETAILS ON THESE EXCITING NEW POLAR BEAR SERIES™ MACHINES AT GRIZZLY.COM®



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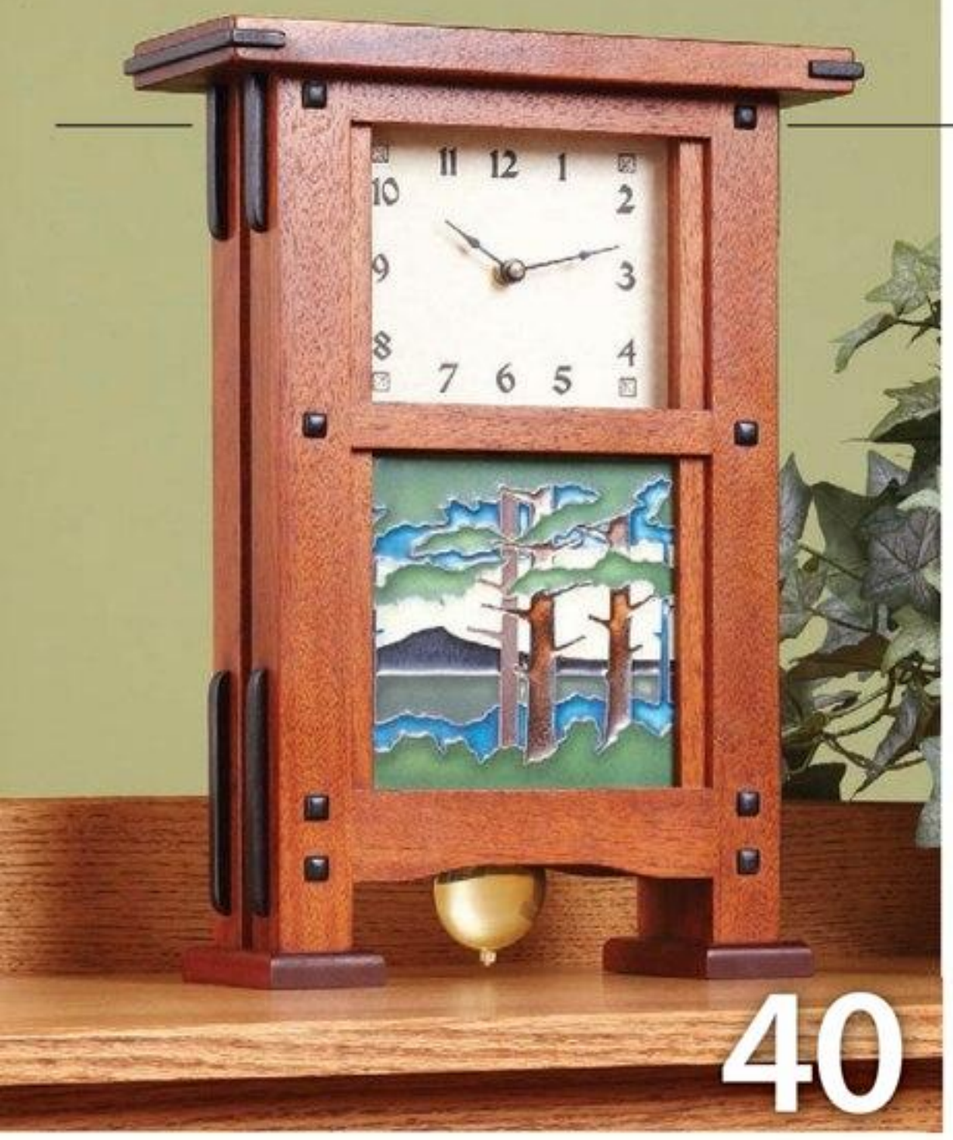

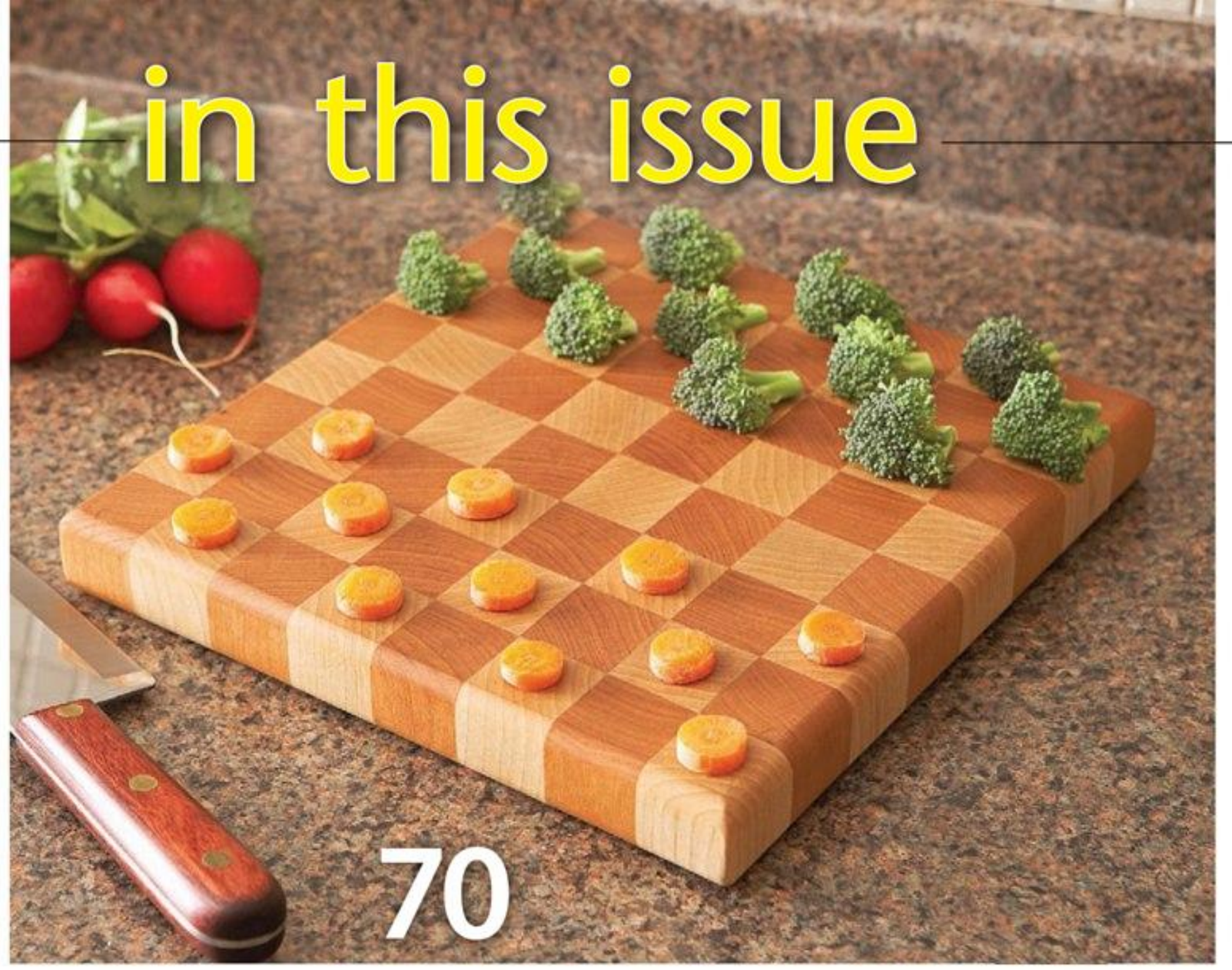

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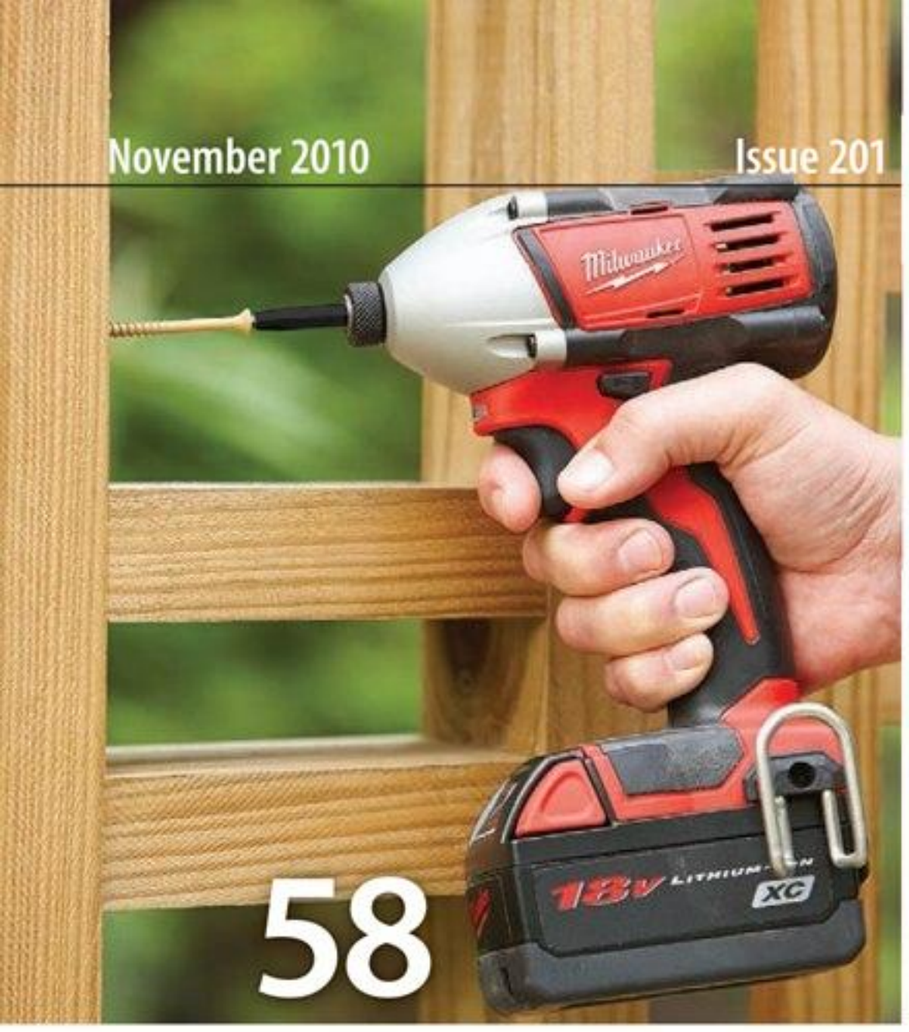

This seal is your assurance that we build every project, verify every fact, and test every reviewed tool in our workshop to guarantee your success and complete satisfaction.

on our website

woodmagazine.com

10 THINGS TO BE THANKFUL FOR THIS YEAR

- **Woodworkers Who Share:** woodmagazine.com/forums
- **Gorgeous Figured Hardwoods:** woodmagazine.com/woodfigure
- **Jim Heavey's Expert Advice:** woodmagazine.com/JimHeavey
- **Accurate Measuring Tools:** woodmagazine.com/meastools
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GIVE YOURSELF THE GIFT OF LEARNING

Take some time to become a better woodworker. Rent any of these skill-building videos for only $3.99 at youtube.com/wood

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- **Doors and Drawers Made Easy**
- **9 Simple Woodworking Joints**
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- plus shorter videos for **only 99 cents!**

SHARE YOUR CLUB'S CHARITY PROJECTS

Woodworkers are the most giving people we know, especially during the holidays. Show and tell us about your woodworking club's latest charitable efforts in the Holiday Gifts Gallery at woodmagazine.com/galleries.

The "Sawdust Santas" from Laingsburg, Mich., display the toy ducks, caterpillars, and baby cradles they made for "Santa's Bag," a local charity.

INNOVATIVE PRODUCTS SINCE 1989!

2 YEAR WARRANTY

SHOP FOX® machines are backed by a 2 Year Warranty!

3 HP LOW PROFILE CYCLONE DUST COLLECTOR

- Motor: 3 HP, 220V, single-phase, TEFC class "F"
- Amps : 22 • Cycle/RPM: 60 Hz/3450 RPM
- Air suction capacity: 1489 CFM
- Max. static pressure: 10.2"
- Intake hole: 8"
- Impeller size: 14½"
- Sound level: 83 dB
- Filter: 99.9% efficiency from 0.2-2 microns
- 55 gal. steel collection drum with casters
- Remote controlled magnetic switch
- Approx. shipping weight: 403 lbs.

New

Only 80" Tall!

W1816 Dust Collector

VARIABLE SPEED PLANER/MOULDER with STAND

PATENTED

- Motor: 2 HP, 220V, single-phase
- Precision ground cast iron table & wings
- Table size with wings: 36¼"L x 10"W
- Max. cutting width: 7"
- Max. planing height: 7½"
- Max. planing depth: ⅛"
- Max. moulding depth: ¾"
- Knife size: 7⅛" x 1½" x ¼" HSS
- Cutterhead speed: 7000 RPM
- 4" dust port
- Approx. shipping weight: 330 lbs.

We also carry an extensive selection of moulding knives for this machine!

W1812 Planer/ Moulder

8" JOINTER
with Parallelogram Adjustable Beds

- 3 HP, 220V, single-phase, TEFC motor
- Precision ground cast iron parallelogram design table measures 8" x 76⅝"
- Cutterhead speed: 5350 RPM
- W1741 cutterhead: 4 HSS knives
- W1741S cutterhead: 4 rows, 74 carbide inserts
- Rabbeting capacity: ⅝"

Built-in Mobile Base

W1741 8" Jointer
W1741S with Spiral Cutterhead

SPIRAL CUTTERHEAD PLANERS
with Built-in Mobile Base

- 3 HP or 5 HP, 220V, single-phase motor
- Precision ground cast iron table & extension wings
- 2 speed gear box
- 2 adjustable bed rollers
- German-made carbide insert spiral cutterhead
- Pedestal mounted thermal overload magnetic safety switch
- Built-in locking mobile base

W1742S 15" Planer
W1754S 20" Planer

10" TABLE SAWS with Riving Knife

New

- 3 HP, 220V, single-phase motor
- Cast iron table size: 27" x 40¼"
- Table size with extension: W1819 - 27" x 53⅝", W1820 - 27" x 74⅜"
- Arbor: ⅝", 4300 RPM
- Max. rip capacity: W1819 - 29½", W1820 - 50"
- Max. depth of cut: 3⅛" @ 90°, 2³⁄₁₆" @ 45°

Free 10" Carbide-Tipped Blade

W1819 10" Table Saw
W1820 10" Table Saw with Long Ext. Table

OUTSTANDING SHOP FOX® ACCESSORIES

ADJUSTABLE MOBILE BASES

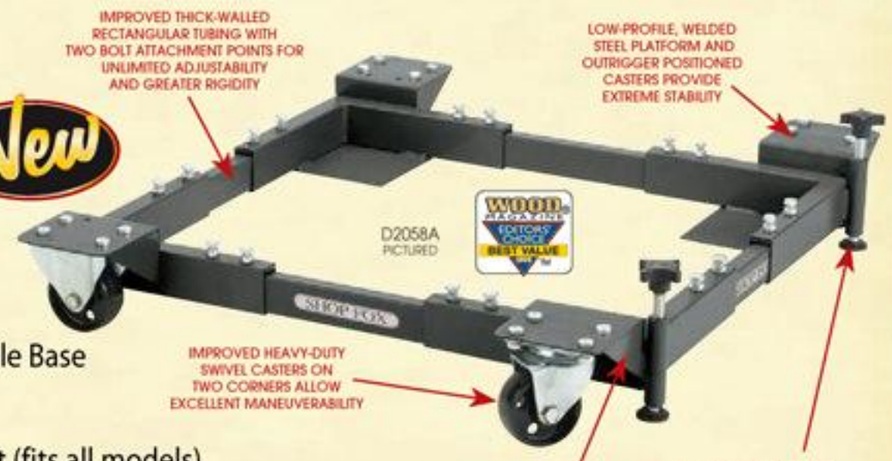
STRONGER FRAME WITH IMPROVED WHEELS AND GUSSETED SUPPORTS!

D2260A
Mini Mobile Base
600 lb. capacity

D2057A
Heavy-Duty Mobile Base
700 lb. capacity

D2058A
Super Heavy-Duty Mobile Base
1300 lb. capacity

New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D2058A PICTURED
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D2259A Extension Kit (fits all models)
D2246A 36" Extension Bars (fits all models)

RIGHT ANGLE JIG

Cut tenons, dados, rail ends and finger joints safely & with complete accuracy. The SHOP FOX® Right Angle Jig is constructed using top quality aluminum castings & plates which are machined to exacting tolerances.

- Solid aluminum
- Extended depth: 13"
- Closed depth: 7½"
- Height: 8"
- Max. horiz. opening: 1¾" x 8"

ADJUSTABLE ROLLER STAND

- Stand length is adjustable from 19½" to 54"
- Number of rollers: 9
- Stand height adjusts from 24½" to 38"
- Roller diameter: 2"
- Two-way locking swivel casters: 4¼" diameter
- 300 lb. capacity

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November 2010 | Vol. 27, No. 6 | Issue No. 201

Who has had the greatest influence on your woodworking?

…Dale Nish, professional woodturner & demonstrator. His methodical and practical approach to turning inspires.

…My wife, Jennifer — some of the projects I built for her were in the photos and drawings I submitted with my résumé to WOOD…and I got the job.

…Marlen Kemmet, who has been generous with his advice and direction.

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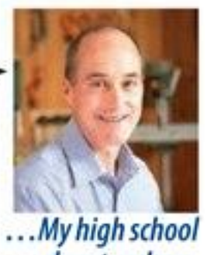

…My high school shop teachers. Mr. Vick & Mr. Fuchs: if you're still out there, thanks!

…The people at the woodworking magazines I've worked on. I learn something from people of all skill levels.

…My father and grandfather, who taught me their skills.

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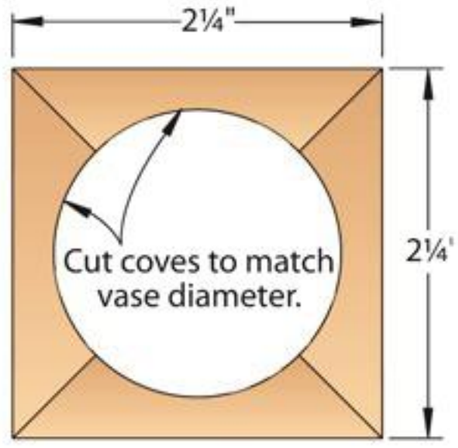
Sounding Board

Our bulletin board for letters, comments, and timely updates

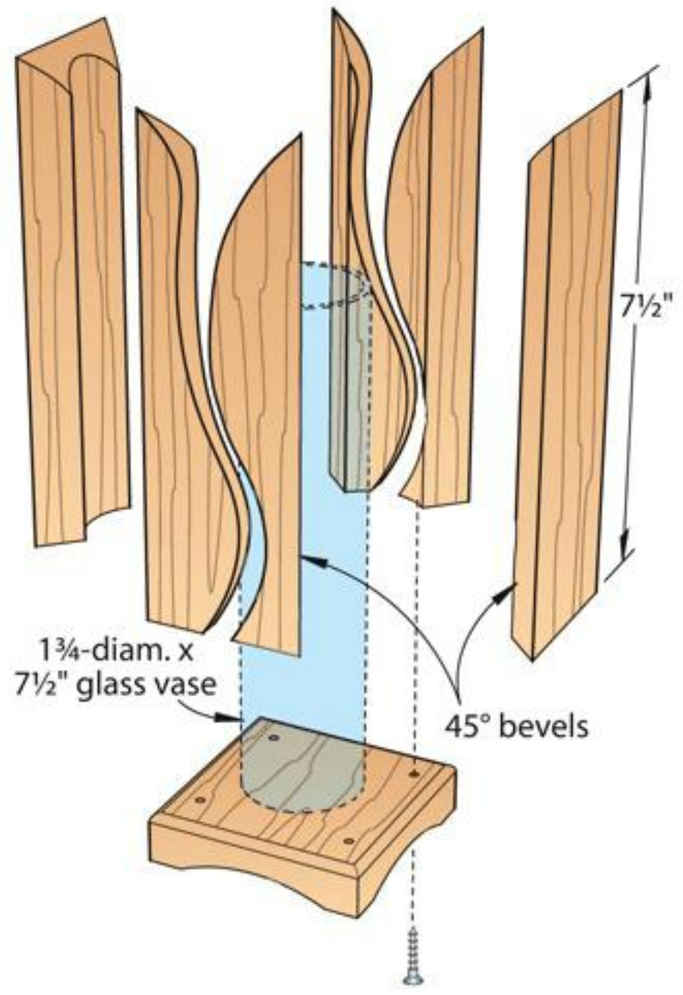
Complementary bud vases draw compliments

I wanted to make the Bud Vase in issue 194 (November 2009), *right*, but my drill press lacks enough stroke to bore the full length of the vase holder, even from both ends. Here's how I got around that challenge. First, I cut a ½"-deep cove diagonally (about 15°) across my tablesaw down the center of four 7½"-long pieces of 1¼"-thick ipe. Next, I cut 45° bevels on both edges of each piece. After sanding the faces smooth, I glued the pieces together to form the vase-holder blank. (See **END VIEW**.) When I cut out the side reliefs on the bandsaw using your full-size pattern, I found a surprise. By making the blank 7½" long—rather than the 7" in your plans—another vase holder, shown *below right*, emerged in the cutaway piece. I built another base for it to give me a complementary Bud Vase.



END VIEW

—*Russell Glock, Southern Shores, N.C.*



Can I make and sell *WOOD*® magazine projects?

I turned several toothpick holders from issue 182 (March 2008) and gave them as gifts. Now, my friends want me to make more and sell them. I'm not looking to make lots of money, but would like to cover my expenses. Is it okay to make and sell projects from your magazine?

—*Bernie Weishapl, Goodland, Kan.*

That depends, Bernie. Most of our projects are designed by members of our staff, and you can make as many as you like of those for yourself or as gifts. We do put a limit of 25 on these projects if you intend to sell them. Check the credits at the end of the article. If you see the project designer's name anywhere above the list of photographers on page 4, *that designer is a staff member. Projects designed by nonstaff designers can be built only for yourself or as gifts; you cannot sell those projects. Brian Simmons, our freelance woodturning consultant, designed the toothpick holder and holds the design rights, so you cannot make and sell the holders without authorization from Brian.*

—Marlen Kemmet, Managing Editor

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Shop Tips

Helping you work faster, smarter, and safer

Top Shop Tip

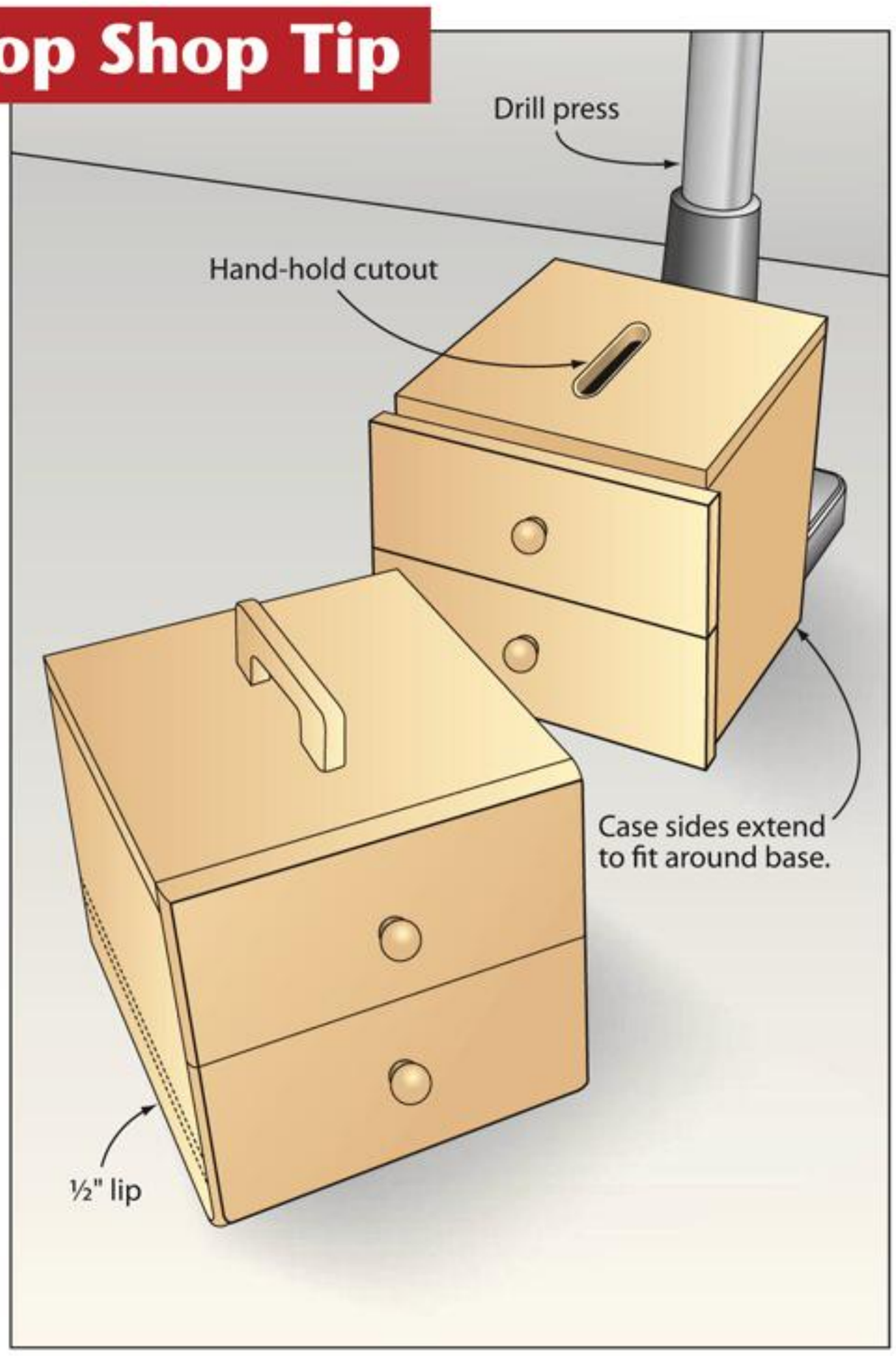
This down-low storage solution is top-drawer

As an electronics-engineer-turned-professional-woodworker, I see the wasted space under the table of a floor-model drill press as a "bug" waiting to be fixed. I solved it by constructing these simple, stackable drawer units using ¾" plywood for the cases and pine for the drawers.

Overhanging sides on the bottom unit straddle the drill-press base to keep it in place. I made the top unit 1½" wider than the bottom one with a ½" bottom lip that nests the two together.

With a total height of 24" when stacked, I still have a good 14" between the chuck and the table. The handle on the upper unit and the hand-hold cutout on the bottom one lets me move them aside when I need more drilling capacity.

—Bill LaPrade, Westborough, Mass.



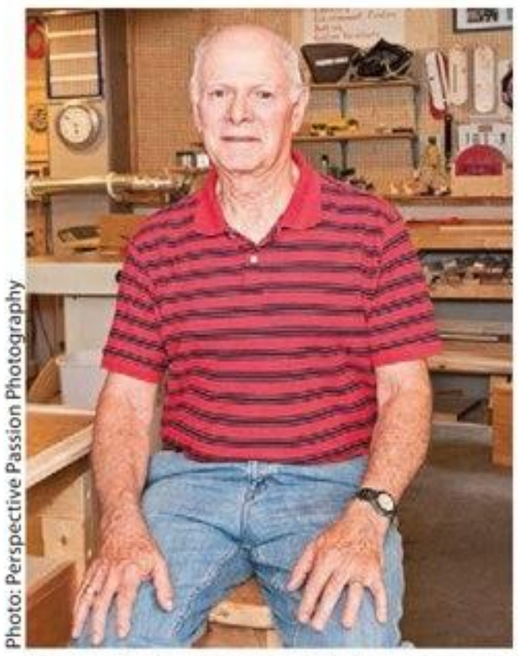


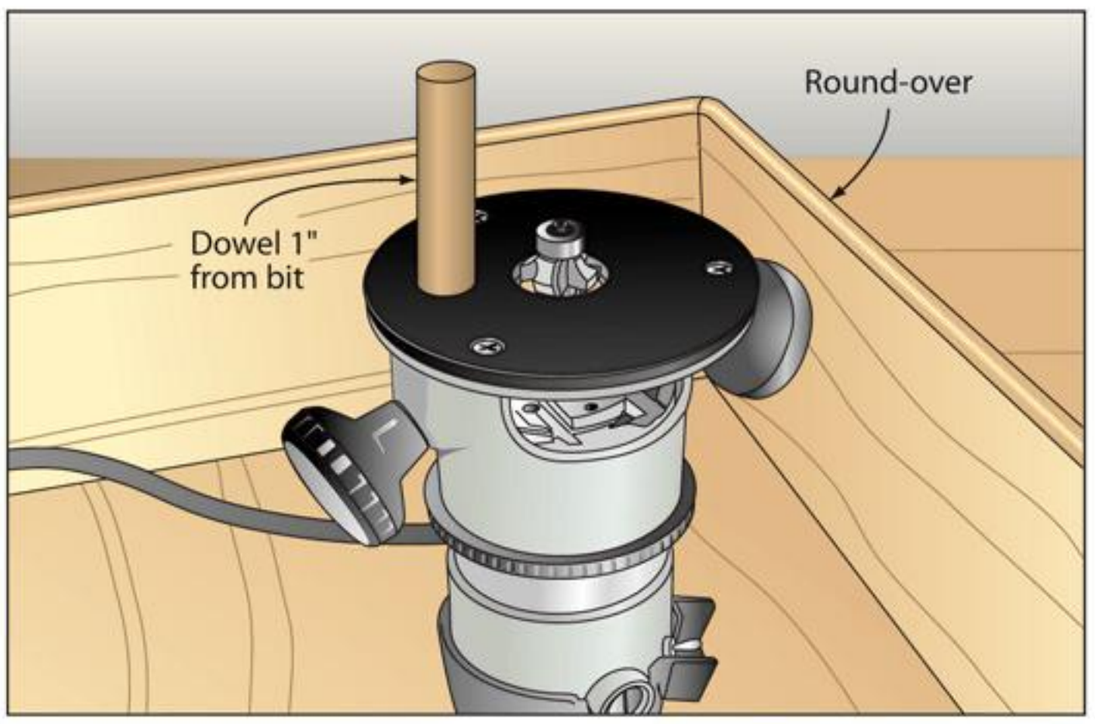
Photo: Perspective Passion Photography

You get a top-notch Top Shop Tip, and Bill LaPrade gets a Bostitch CPACK300 three-tool-and-compressor combo kit. Way to go, Bill!

A straight-up router makes edges round

To round-over narrow pieces, such as the edges of a drawer, I drilled a hole through my router's subbase, and screwed to it a short length of dowel, spaced 1" from the bit. While routing the drawer sides, I rotate the router to squeeze the drawer edge between the dowel and the bearing-guided round-over bit. The dowel keeps the router perpendicular to the edge.

—Christopher Murphy, Santa Fe, N.M.



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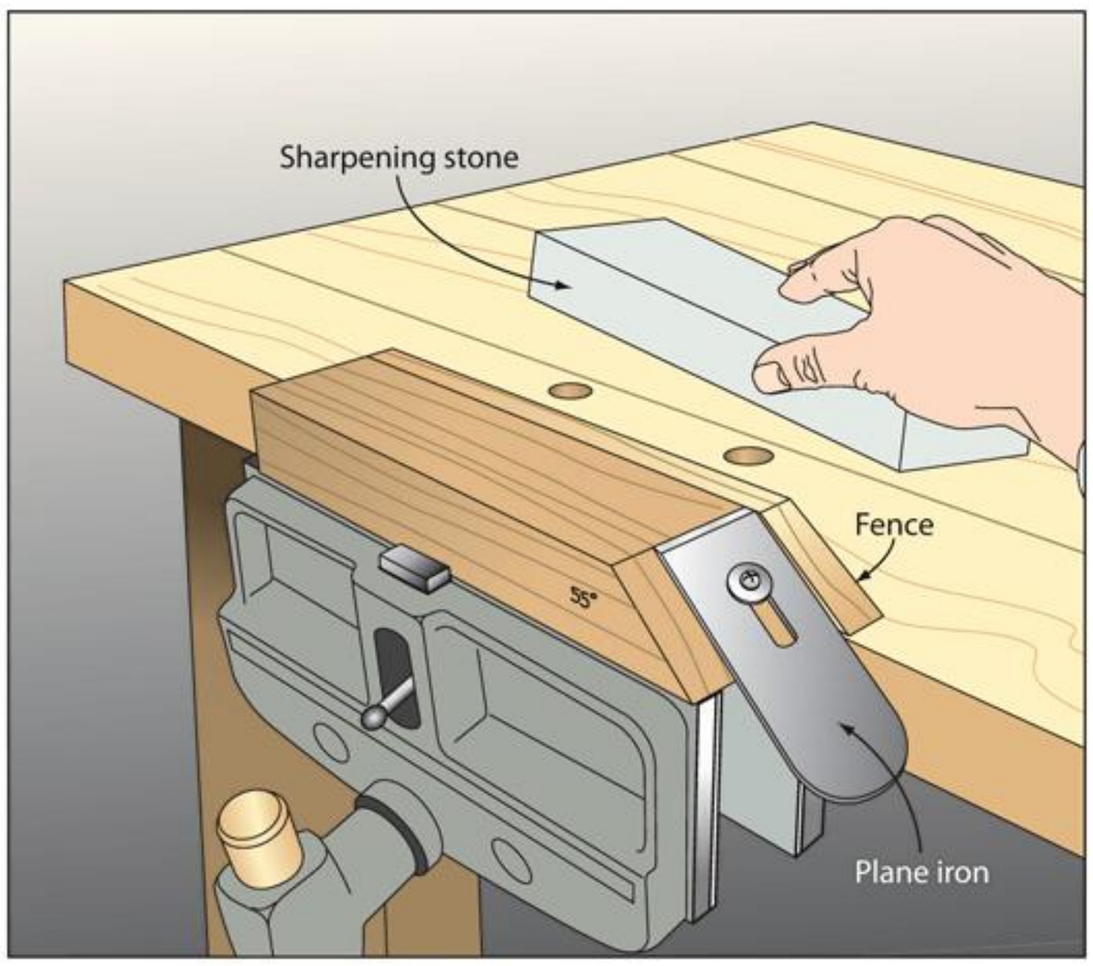
Inexpensive jig turns sharpening on its head

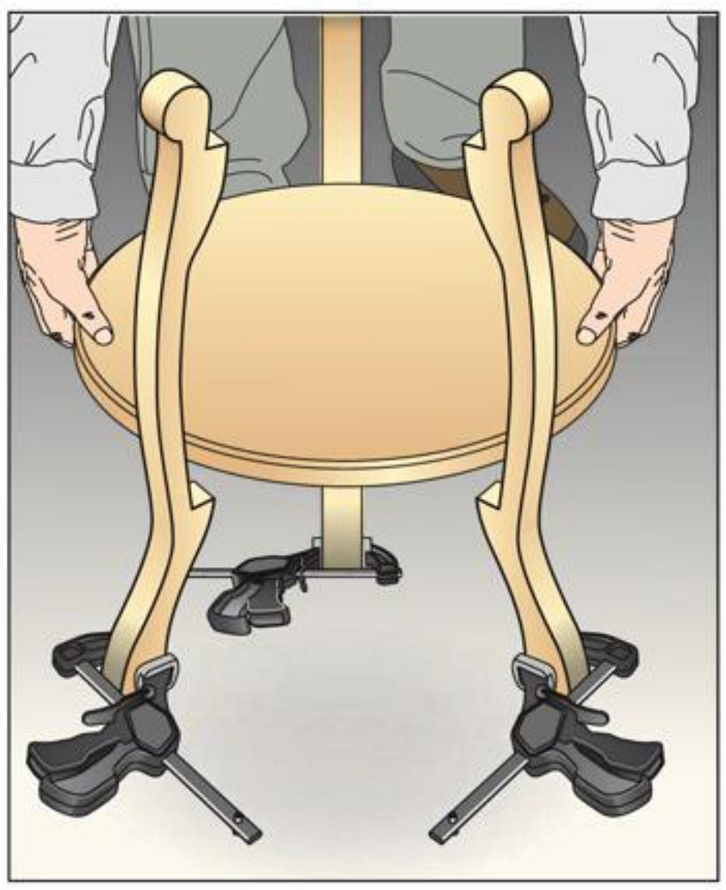
This scrapwood jig helps you sharpen plane irons accurately and quickly. To build it, bevel the ends of two scrap boards (one about 3" thick, 4" wide and 8" long, and the other about ¾×3×8" as shown, to match the bevel angle of the plane iron. Leave the smaller board about ⅛" forward of the other to create a fence to square the iron against; then glue the two boards together.

Position the plane iron against the fence with the bevel slightly above the top face of the jig, and secure it with a screw and washer. Now, guide your sharpening stone against the top of the jig to sharpen the iron in no time.

—Don Hansen, Silver City, N.M.



Temporary feet make up for too few hands



My wife and I make crafts to sell at fairs and festivals. Recently, we decided to branch out with this three-legged table design, but even with two sets of hands, we found it difficult to hold the legs upright while placing the tabletop and shelves. My wife hit on the idea of using bar clamps at the base of the legs as temporary supports. It was like having extra hands to help us.

—Rev. and Mrs. Frank Ingram, Gibson, N.C.

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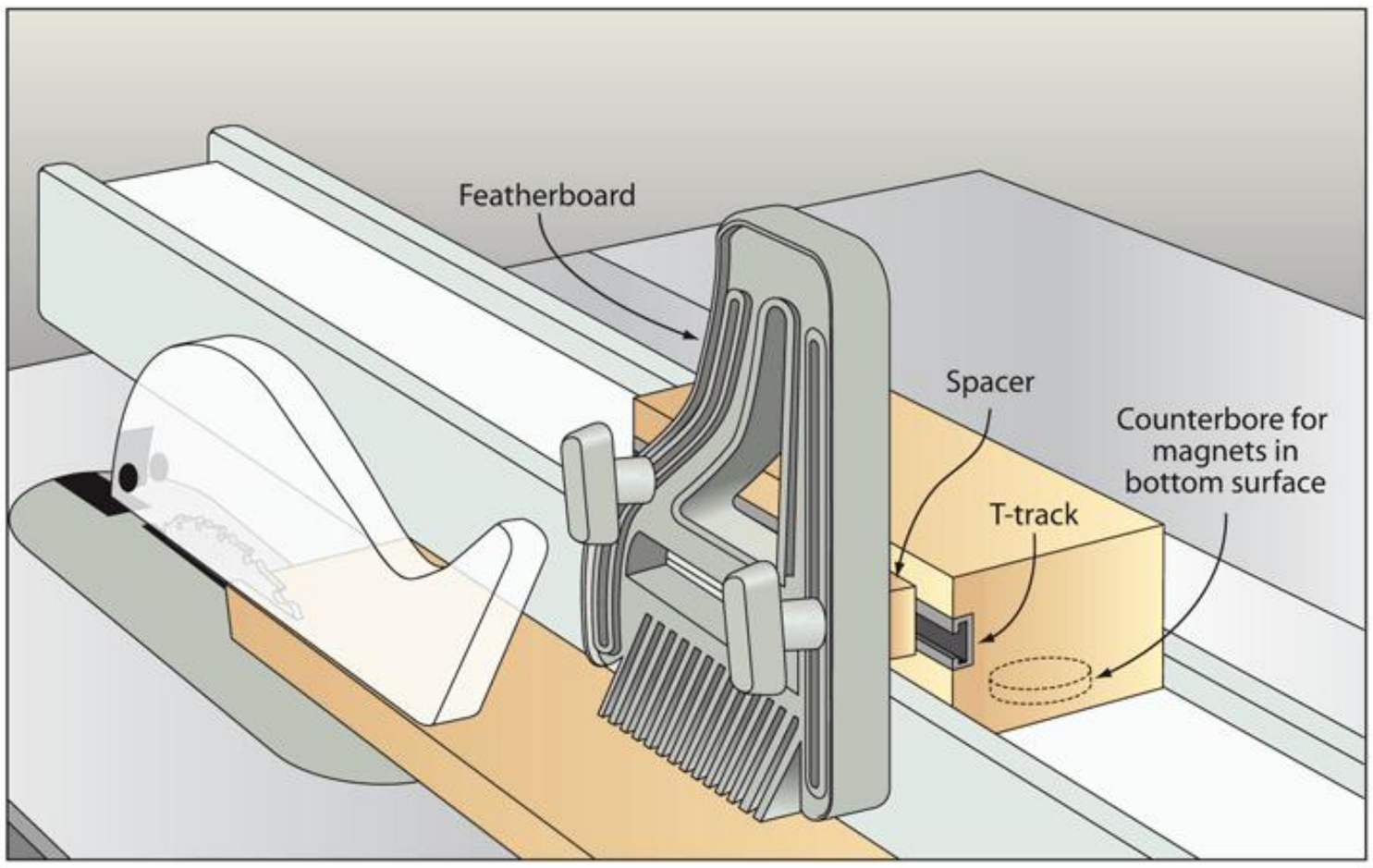
Shop Tips

Featherboard enjoys on-again, off-again attraction

I didn't want to ruin my brand new tablesaw fence by attaching permanent fixtures for featherboards. So I came up with this removable jig.

Sized to fit between the fence faces, the magnetic mounting block can be placed anywhere along the fence. Two spacers, each the thickness of the fence face, attach between the mounting block and the featherboard using ¼"-20 knobs that thread into nuts in the T-track. Between uses, the jig stores on the edge of my cast iron tablesaw wing.

—John Vento, Parkville, Mo.

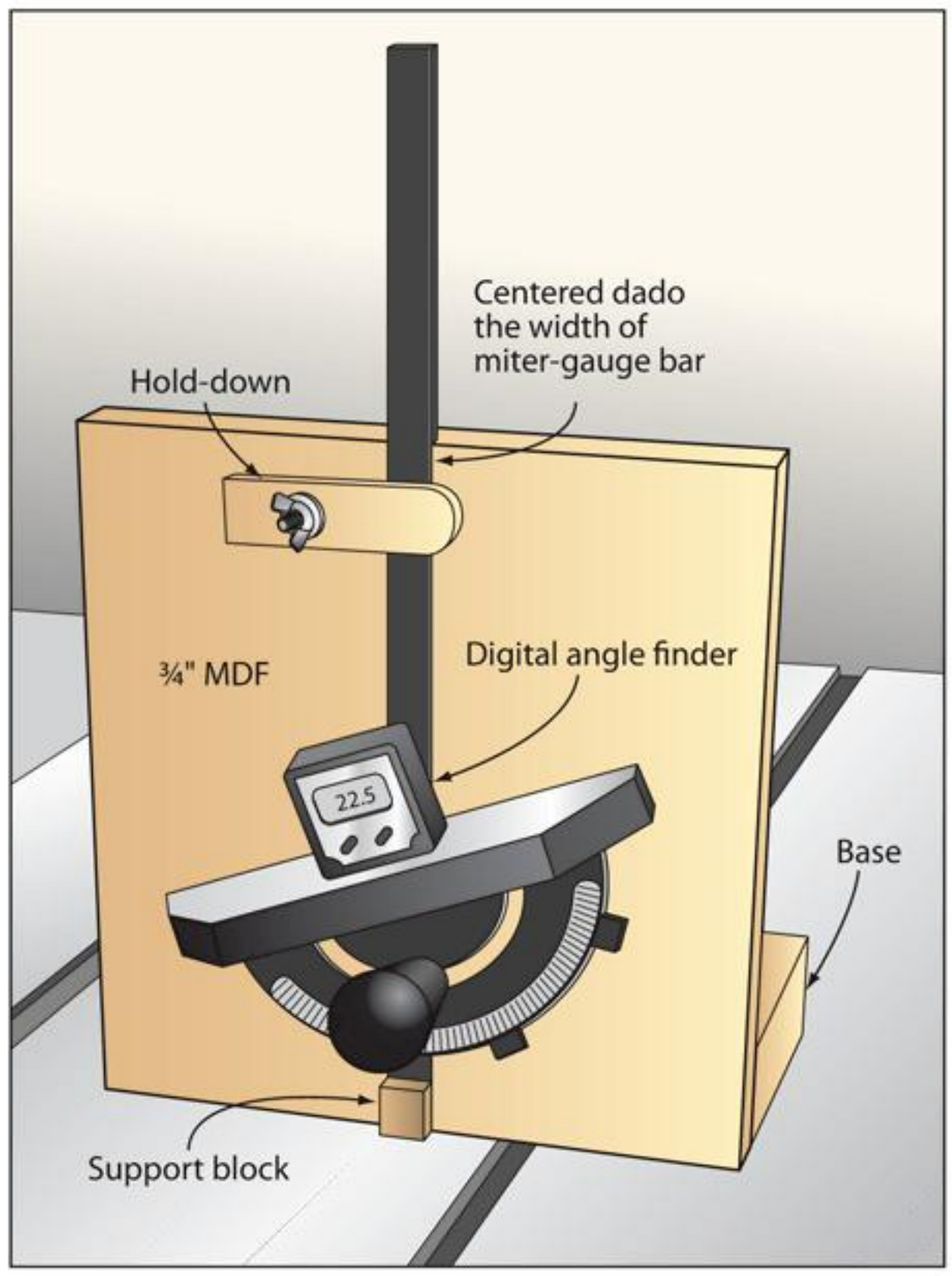


Set precise angles vertically and digitally

Here's a way to dial in your miter gauge for tricky angles, such as for a seven-sided frame. Cut a piece of ¾" MDF wider than your miter gauge, as shown. Then center a dado in one face to fit your miter-gauge bar, and add the base, support block, and hold-down.

To set an angle, insert your miter gauge into the jig, stand the jig on end, and zero a digital angle finder (such as a Wixey, Rockler item no. 27487, 800-279-4441, rockler.com) on the face of the miter gauge. Loosen the scale on the miter gauge and tilt the miter gauge head until the angle finder reads the desired angle. Now tighten the gauge and start making uber-precise miter cuts.

—Bob Wilson, Urbandale, Iowa



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Router bit "drills" odd- and over-size holes

While building the mantel clock project from issue 194 (November 2009), I wanted a more precise method than jigsawing to fashion the 3 3/16" hole for the clock movement. Here's the simple jig I came up with for easy odd-sized holes.

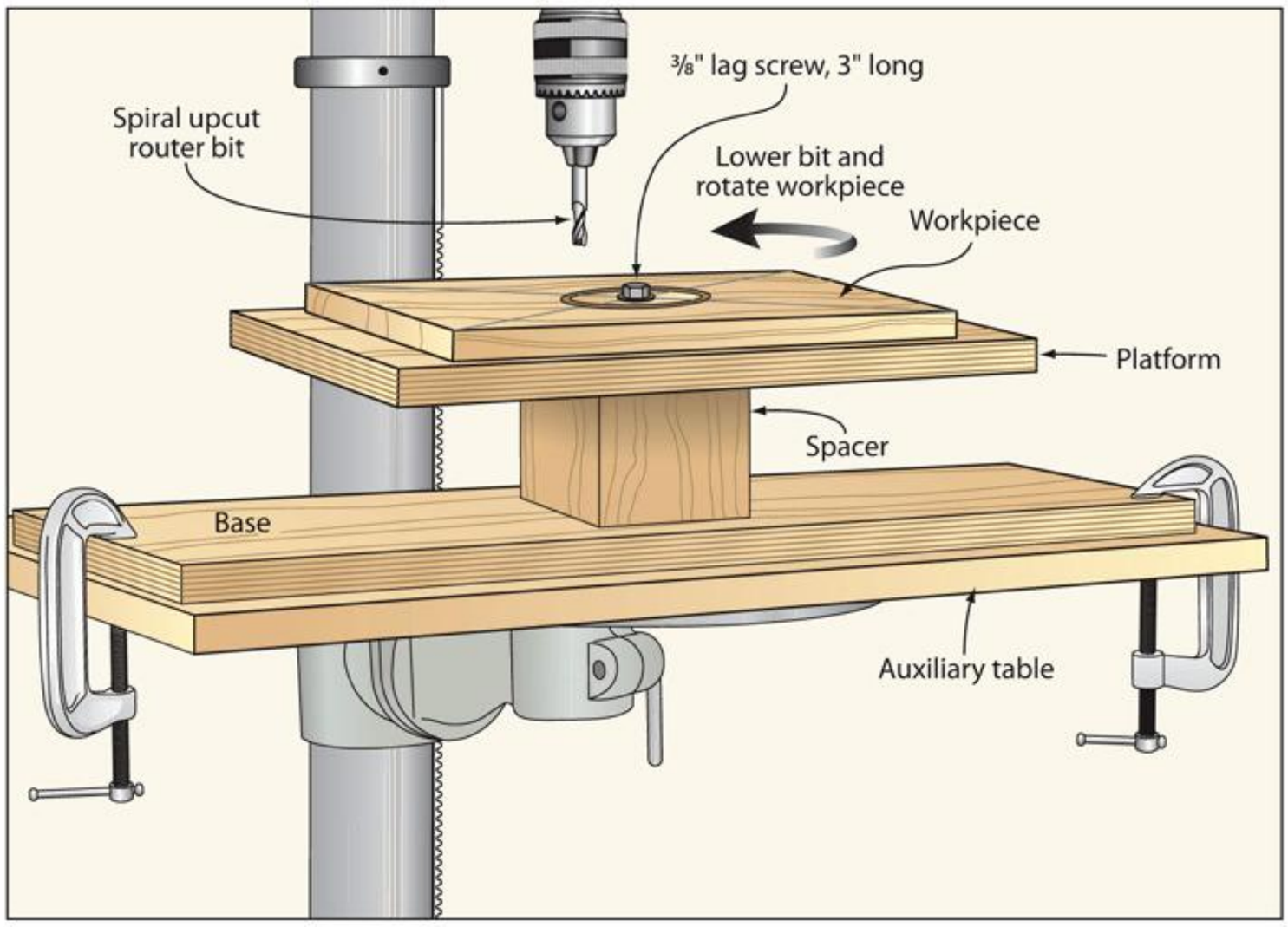
The jig consists of two scraps of plywood—the base sized to fit on your auxiliary drill-press table, the platform sized to rotate without hitting the drill-press column—and a 3½" long scrap of 4×4 lumber as a spacer.

Center, glue, and screw the spacer to the base, and the platform to the spacer. Next, drill a ⅜" clearance hole, centered, through the platform.

After laying out the clock face on your workpiece, drill a ⅜" hole through its center point. Mount the workpiece to the platform using a 3"-long, ⅜" lag screw and washer, as shown, leaving the lag just loose enough so the platform turns freely.

With a ¼" spiral upcut router bit chucked in the drill press, clamp the base to the table, positioning it so the bit will cut just inside the marked circle on the workpiece. Set the depth stop to ¼" depth; then, with the drill press on its highest speed setting, lower the bit and turn the workpiece to complete the circle. Repeat the cut, lowering the depth stop an additional ¼" each pass to complete the cutout.

—Frank Rasberry, Bedford, Texas



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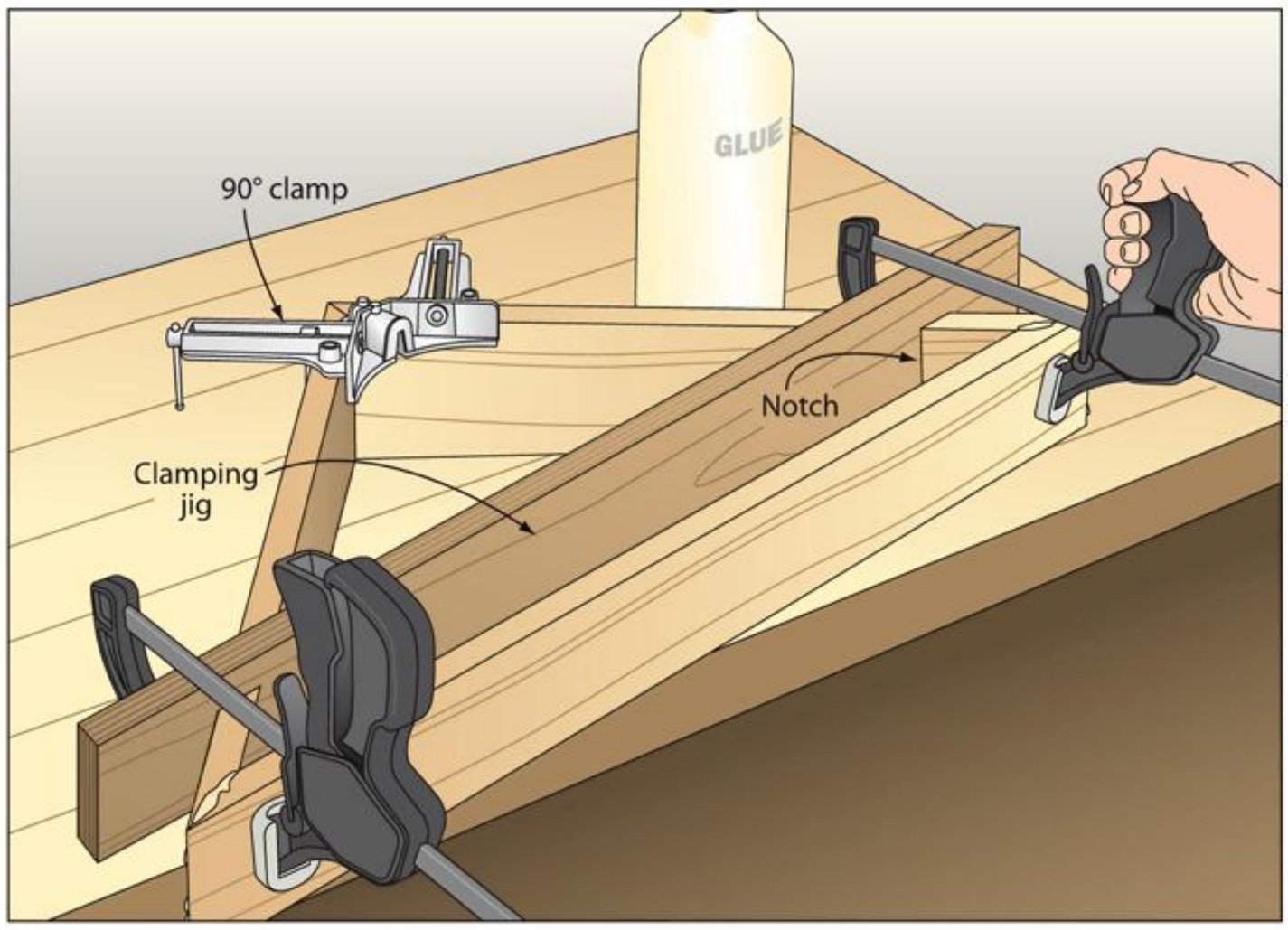
Slick trick for clamping corners

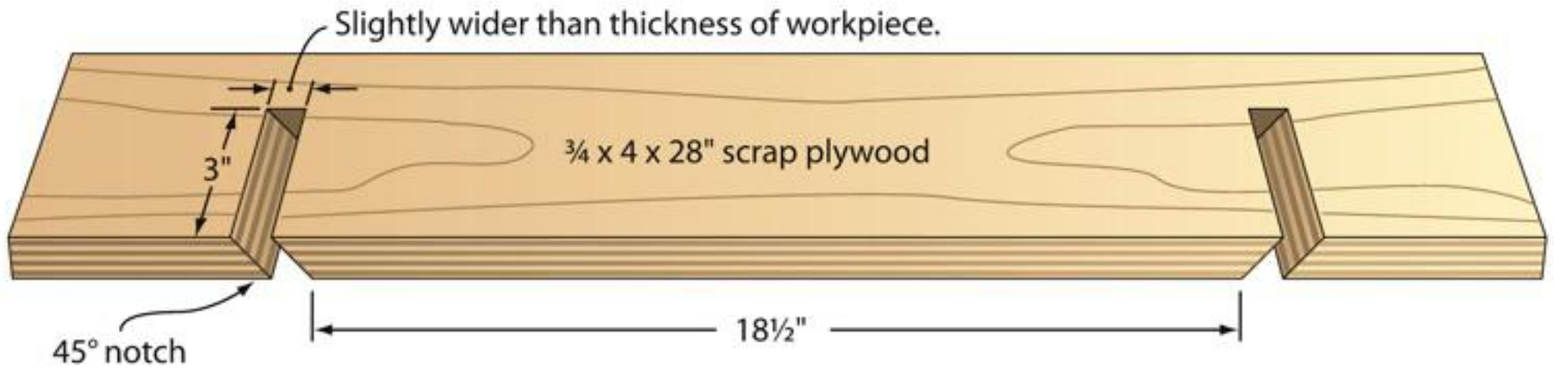
While making several memorial flag cases for my nephew's Marine Corps unit, I realized that gluing and clamping a 45° corner is not as easy as it seems. After a little thought, I came up with the solution you see here.

The location of the angled notches isn't critical; simply set the scrap a couple of inches above the bottom piece on the dry-assembled flag case and then mark where the sides cross. I used my radial-arm saw to make the 3"-deep, 45° notches.

When you're ready to assemble, use a standard 90° clamp on the square corner. For the bottom angles, slide the clamping jig over the sides and clamp, as shown. If you use biscuits or splines in the joints, you won't have to worry about the corners slipping.

—Ray Girard, Gainesville, Fla.





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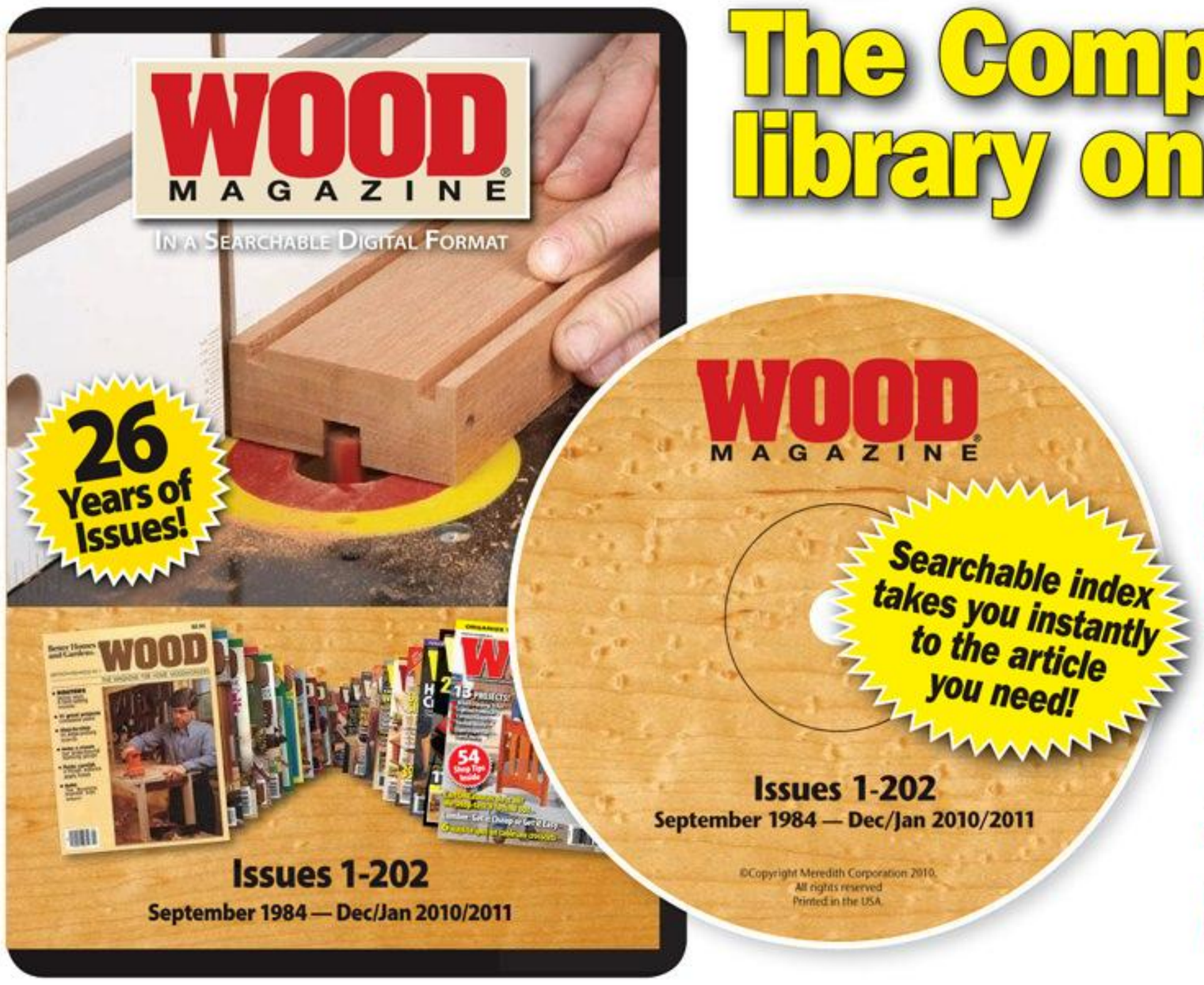

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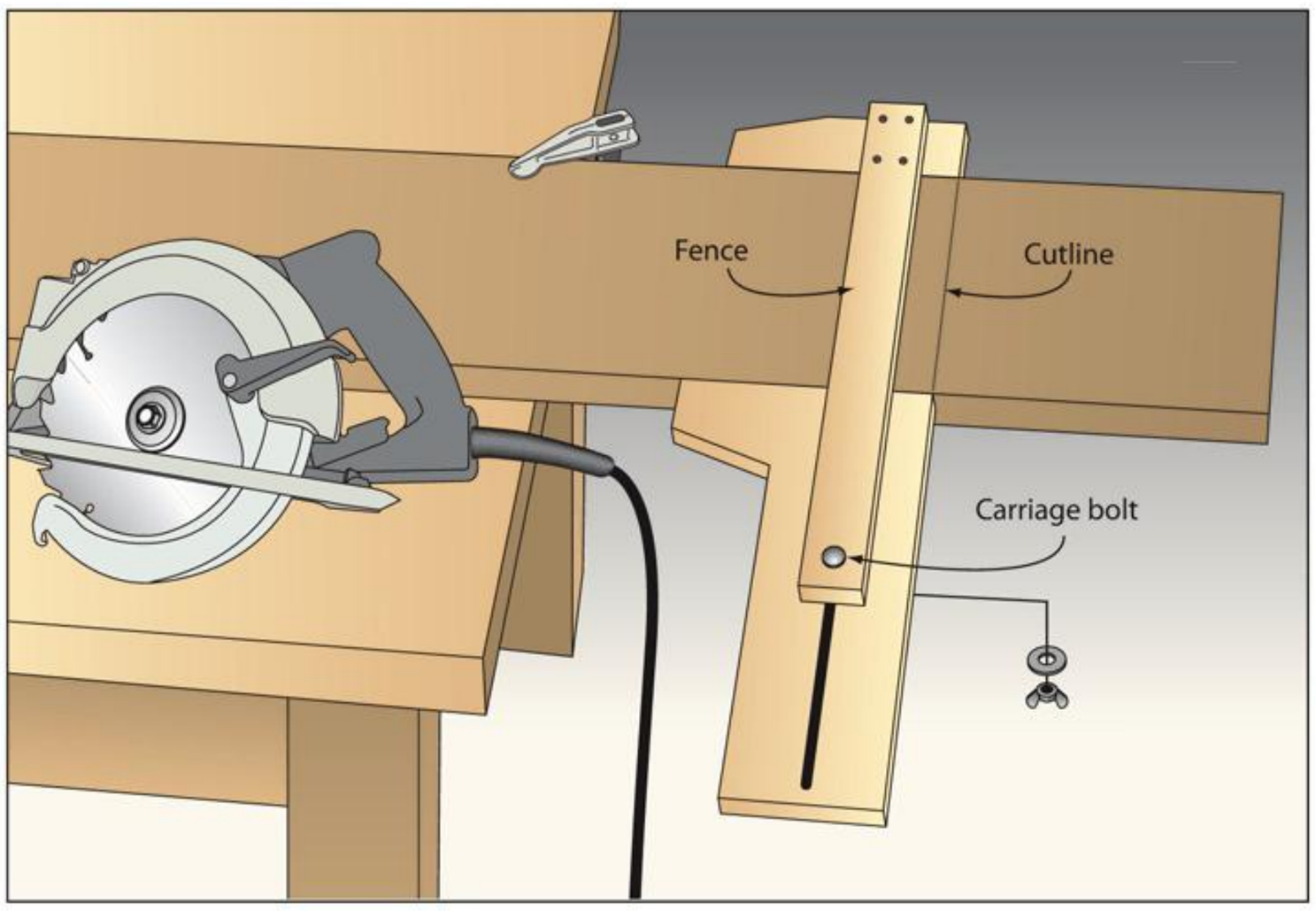
Quick-align circ saw jig

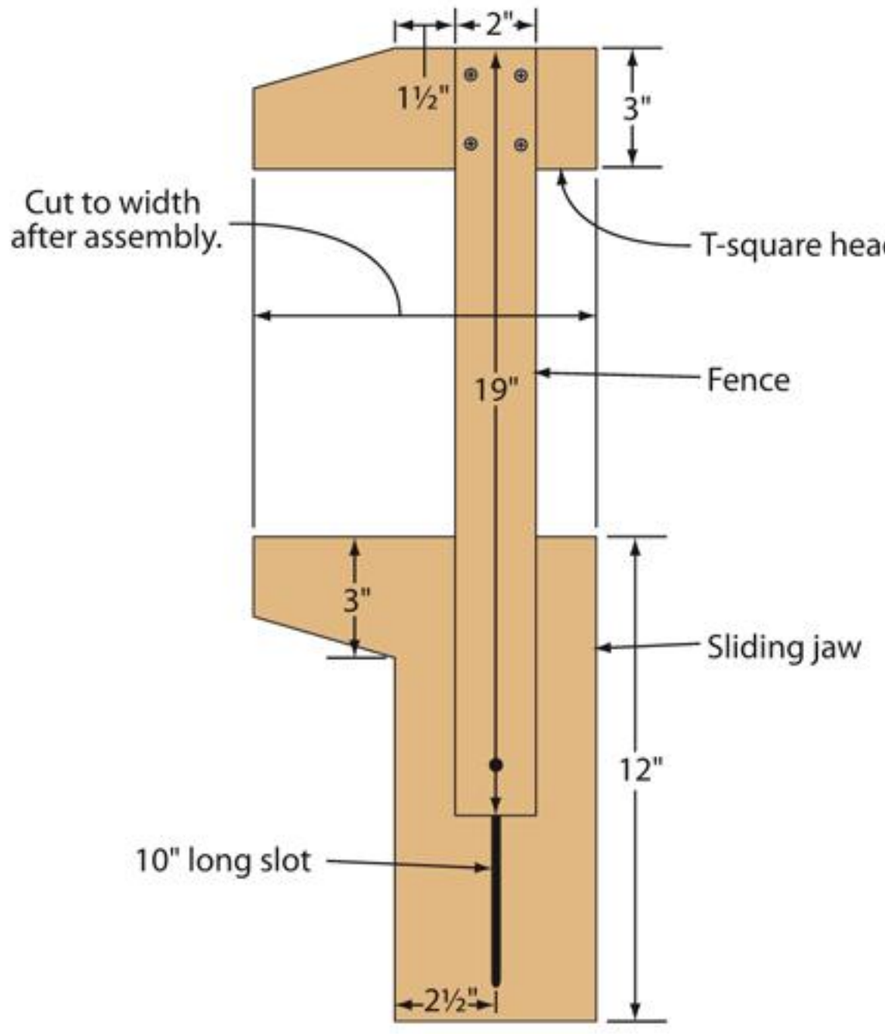
This circ-saw fence helps me cut squarely and precisely to a mark. The sliding jaw locks in place with a thumbscrew, keeping it snug against the workpiece.

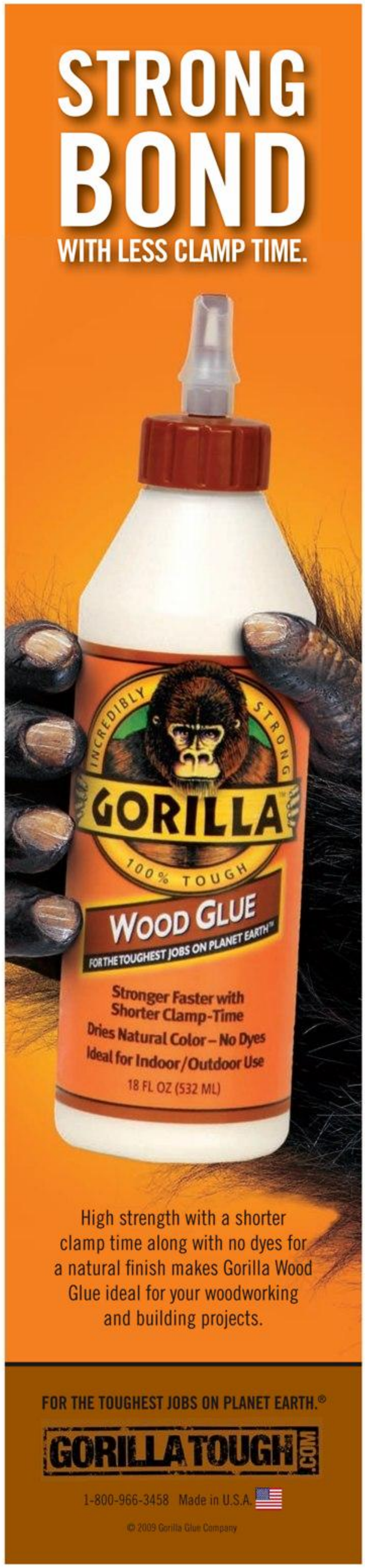
The jig shown is for my left-bladed saw, and the 1½" width to the right of the fence represents the distance from the edge of the saw base to the blade. On right-bladed saws, this dimension will be longer. In either case, leave more than enough to trim it with your saw after assembly to get a precise zero-clearance edge.

After that, to make a dead-on cut, simply align the end of the T-square head with the marked cutline, close and secure the sliding jaw against the workpiece, and run your saw's baseplate along the fence.

—Chris Boenig, Clarksville, Tenn.



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Don't Get Burned

Five simple fire-prevention tips will keep your shop from going up in flames.

You've heard plenty about protecting yourself from spinning blades or bits. But what about protecting your shop—even when you're not around? A fire can wipe out an extensive investment in tools and materials. If your shop is close to or part of your home, a blaze can even threaten you and your family. Follow these simple tips to avoid a disaster.

❶ Limit flammables

Cut back on the amount of finishes, solvents, and other flammable materials you keep on hand. This reduces a ready—and volatile—fuel source should a fire break out. Buy small quantities, keep them in the original containers, and use up old finishes on shop projects. Properly dispose of materials you haven't used in years.

❷ Detect and defeat

Smoke detectors protect you inside your home, but dust in a shop can set them off. Instead, install a heat detector (above door) with both rate-of-rise (sounds an alarm if the temperature climbs too quickly) and fixed-temperature detectors (alerts you if a set temperature is exceeded). They cost about $50 at home centers and online.

Keep a fire extinguisher near each exit so you can fight a fire and still have an escape route. An extinguisher with an ABC rating fights fires in paper and wood (A), gasoline and other combustible liquids (B), and electrical components (C).

❸ Watch your wires

Repair or replace damaged power cords on tools. When you need an extension cord, choose the proper size: a 12- or 14-gauge cord for benchtop and power hand tools. Avoid placing cords where they will be stepped on or pinched. If you rely on power strips or multi-taps to make one receptacle do the work of several, bite the bullet and add circuits to your shop.

❹ Tidy up

Boy Scouts use wood shavings, paper, and sticks to light a fire. Sound like a corner of your shop? Clean up the kindling and keep combustible material away from heaters, stoves, appliances with pilot lights, and bench grinders that throw sparks.

❺ Finish off finishing rags

Oils in finishes create heat as they cure. Concentrate that heat in a crumpled-up rag or paper towel and it can spontaneously burst into flames. Always lay finish rags flat on the floor or draped over the edge of a bench to dry thoroughly before throwing them away.

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Quick & Easy Jig

Mortising Guides

Some hand-woodworking tasks become a whole lot easier and more accurate when you use a simple guide to help steer the cutting action. A perfect case in point: mortising guides like these two. After you hog out most of the mortise waste at your drill press, these jigs guide your chisel straight down, helping you pare the walls square to the faces and ends of the workpiece. You'll create identically sized mortises and save yourself a lot of time fine-tuning individual tenons.

Pick the right guides

By gluing up four pieces to create the guide opening, you size it perfectly and create precise 90° corners. Depending on the application, make the end and side guides from hardboard or MDF. Both materials provide smooth edges. Use ¼" hardboard guides [**bottom drawing**] when you need to see into small, shallow mortises such as those used for holding decorative square buttons. For larger, deeper mortises, ¾" MDF [**top drawing**] provides a broader support surface for the back of your chisel, keeping the tool vertical as you pare the full depth of the walls.

Size the side guides to match the length of the mortise. For an MDF jig, the width of the end guides matches the workpiece thickness, and the side guides fit between the mortise and the edge of the workpiece [**top photo**]. To maximize glue surface for a jig with hardboard guides, cut the end guides to span the workpiece and both cleats [**bottom photo**].

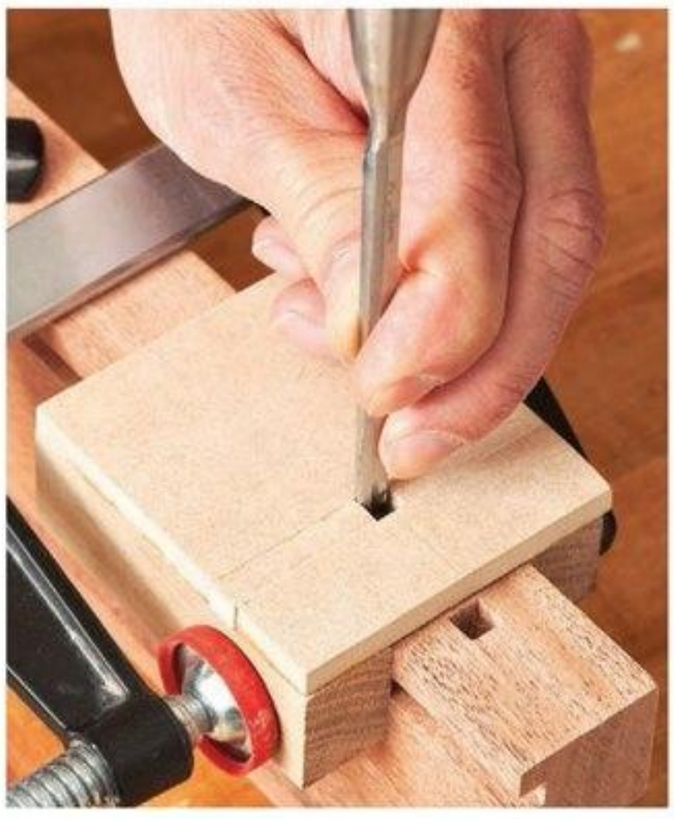
Put the pieces together

To help assemble a hardboard jig, find a scrap the same thickness as the mortised workpiece. Clamp the cleats to either side of the scrap so they stand about ¼" above the edge. Then, one at a time, glue and clamp the hardboard pieces on top of the cleats, ensuring that the opening is square to the cleats and centered on the jig's width.

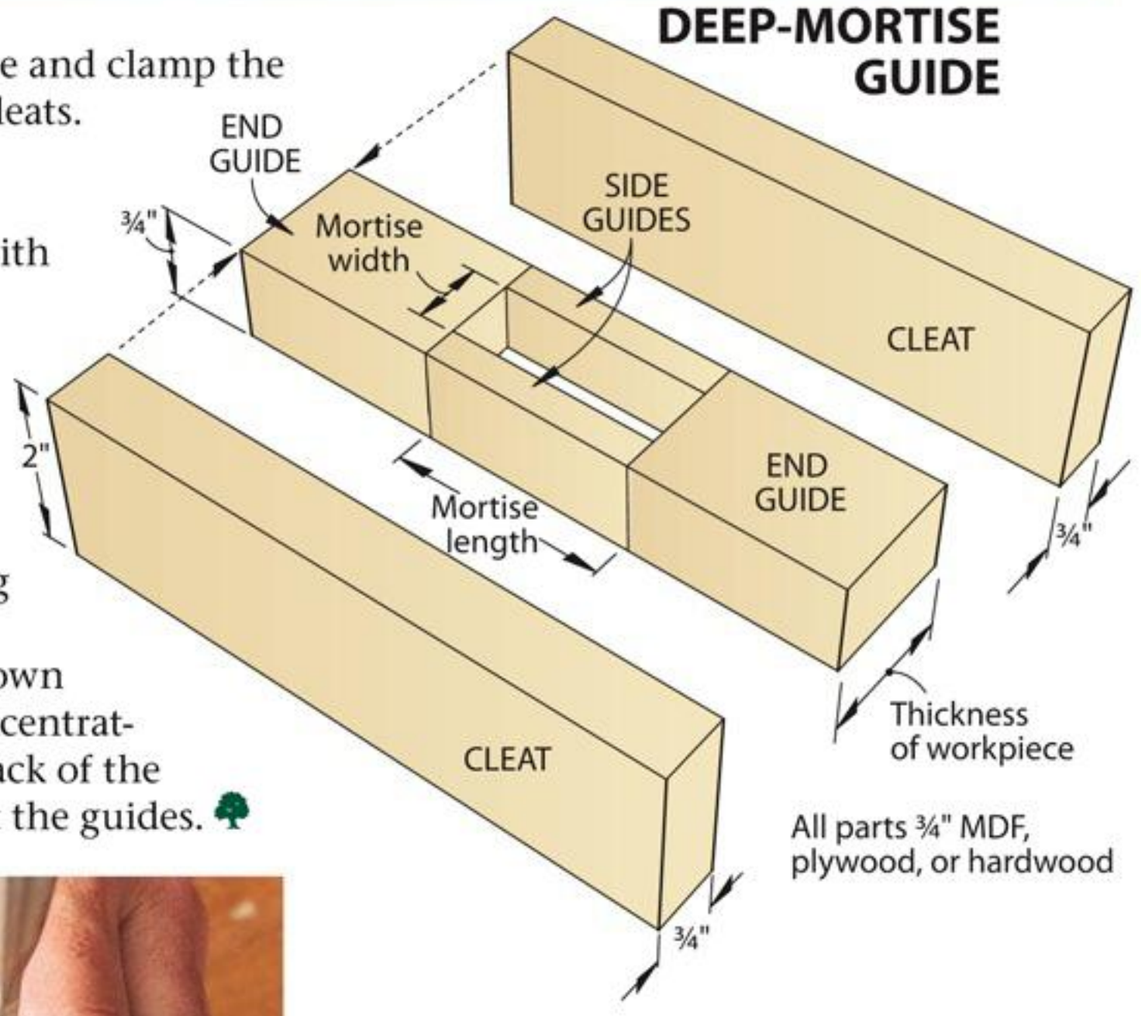
For an MDF jig, glue and clamp the guides between the cleats.

Using the jigs

Clamp a workpiece with the drilled-out mortise to your bench and align the jig opening with the mortise layout lines. Clamp across the cleats to secure the jig to the workpiece. With a chisel, pare down along the guides, concentrating on keeping the back of the chisel pressed against the guides.

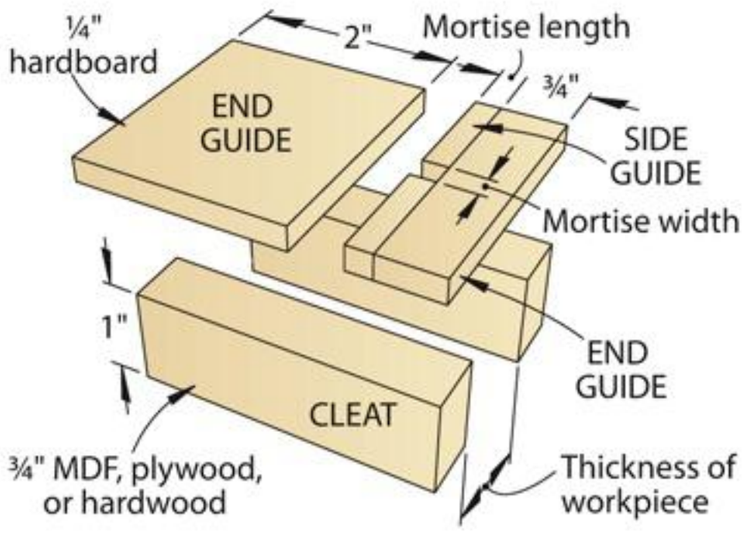


DEEP-MORTISE GUIDE



All parts ¾" MDF, plywood, or hardwood

SHALLOW-MORTISE GUIDE



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The Shop Monkey

Don't be afraid... he's trained.

Bad boards: Beauties or Beasts?

After they got married, my friends Chris and Ann-Sofie had a fancy all-glass dining table with a beautifully beveled thick top and two narrow strips forming each leg.

Then, the kids showed up.

Once the little ones started to crawl... then toddle... then run... that table became a target for an out-of-control youngster taking a corner too sharply.

Concerned about the survival of the table (and the kids), I offered to build them a sturdy trestle-table base for their glass top to rest on. They were happy—and quite relieved—to accept.

The key piece was a beefy maple stretcher, and after digging through a pile of boards at the hardwood store, I found exactly what I was looking for: an 8/4 hard maple board about 14 feet long with only one flaw—a knot right smack in its middle.

Knowing I could work around that imperfection, I asked Earl, the millwork guy, if he could cut the board down to size for transport back to my shop. "Oh," I said, "Be sure to cut out that knot." Earl asked me if I was crazy.

That's when I discovered that woodworkers treasure boards with "defects." Knots. Spalting. Bark inclusions. Wild grain. You name the defect, and there's someone out there looking to take that piece of goodness home.

Woodworkers can find these "scraps" at a huge discount—or even for free—because the biggest hardwood buyers, including large cabinet shops and furniture makers, want boards with a unified appearance. Maple with a subdued grain pattern. Oak with complimentary cathedrals. Hickory with evenly distributed light and dark features. When you're building things *en masse*, you can't take the time to design wood defects into a piece. This one has to look just like the one in the catalog.

But when you take the time to consider each board's unique character, and effectively incorporate it into a design, the payoff can be huge. Those ugly, undesired boards have boldness. Visual interest. A board with character can take your work to another level.

Where can you use these gems? Small ones can serve as an eye-catching handle for a keepsake box, or larger ones made into the box itself. These boards can elevate the face of a simple mantle clock to a work of art. For pieces large enough to resaw, imagine the stunning bookmatched veneer you can create. Even knotholes become door pulls in the eye of the flaw-finessing woodworker. The possibilities are limited only by your imagination.

If you want to harvest the wildest of the grain, you may have to look at the board from different angles to see how to cut the board to get the most eye-popping figure in the final piece. Try outlining in chalk the area you want to cut, or mask it with blue painter's tape, to better visualize the possible results.

Of course, working with these pieces can pose some challenges. For example, crazy grain is more likely to tear out when you send it through a planer. A belt sander or scraper plane may be a much better alternative.

In the end, I built the table base with clear maple boards, and my friends are thrilled with the design and its safety. However, that ugly knot still sits on my special wood shelf, waiting for the perfect project to showcase its beauty.

The Shop Monkey (aka Tom Iovino of Tampa, Fla.) blogs prolifically at woodmagazine.com/shopmonkey.

Rather than discard the sapwood, Contributing Craftsman Jim Heavey displayed it prominently on this cherry table.

Bark inclusions in this hickory pagoda box add intrigue and elegance. (Find plans in issue 176, or search "pagoda box" at woodmagazine.com.)

Roger Gaborski of Pittsford, N.Y., knocked out the knots and turned the holes into natural door pulls on this jewelry cabinet.

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Squaring Secrets for Glue-ups

The right tools and techniques end misalignments.

Quick! You have just a few minutes to assemble the project parts, align the edges, and clamp the joints tight. Oh, and by the way, did you happen to get it square? With the right tools and these helpful hints, your glue-ups will be panic-free and perfect-fitting every time.

A precise glue-up begins with square parts, so make sure your tools (tablesaw, jointer, planer, mitersaw) are properly aligned before you machine parts. (See **More Resources** on *page 25* for a video and articles about tuning up a tablesaw.) Then organize the glue-up on a flat, dust-free surface and use one or more of these clamping aids and techniques for squaring success.

One part squares another

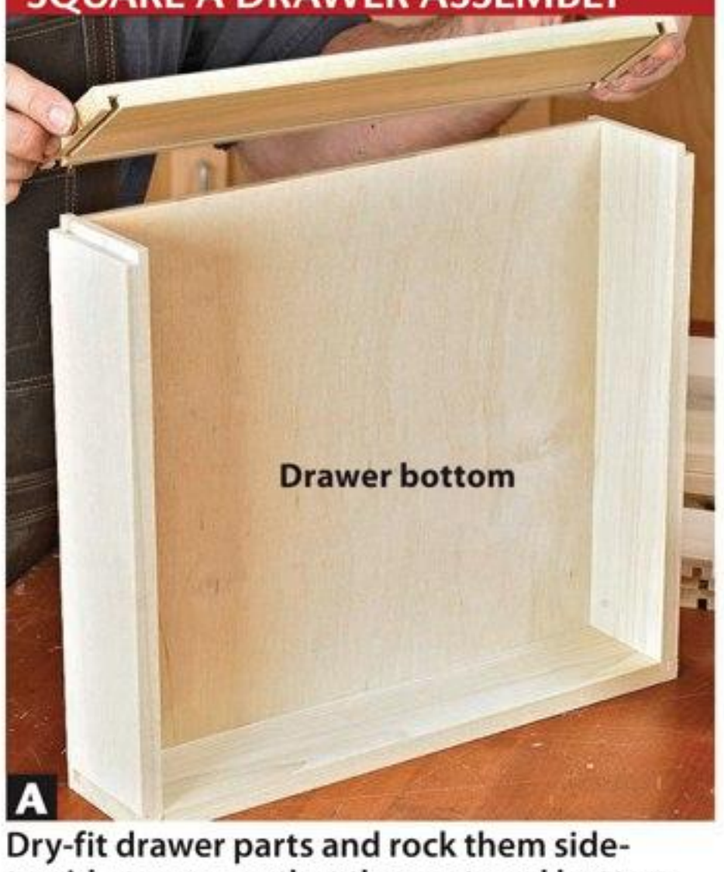
If you machine your parts square to begin with, they'll square each other when clamped correctly. In the example shown *above*, square-cut shoulders on the rails align them perfectly perpendicular to the stiles. The trick here: Make sure the clamp pads sit squarely on the part edges. Applying pressure at an angle can torque parts out of square.

Here's another way to make a glue-up self-squaring: Capture a plywood back or bottom snugly within grooves or rabbets to keep the box or drawer in shape [**Photo A**].

Need a looser-fitting bottom to account for seasonal wood movement?

continued on page 24

SQUARE A DRAWER ASSEMBLY



Dry-fit drawer parts and rock them side-to-side to ensure that the captured bottom squares the sides to the front and back.

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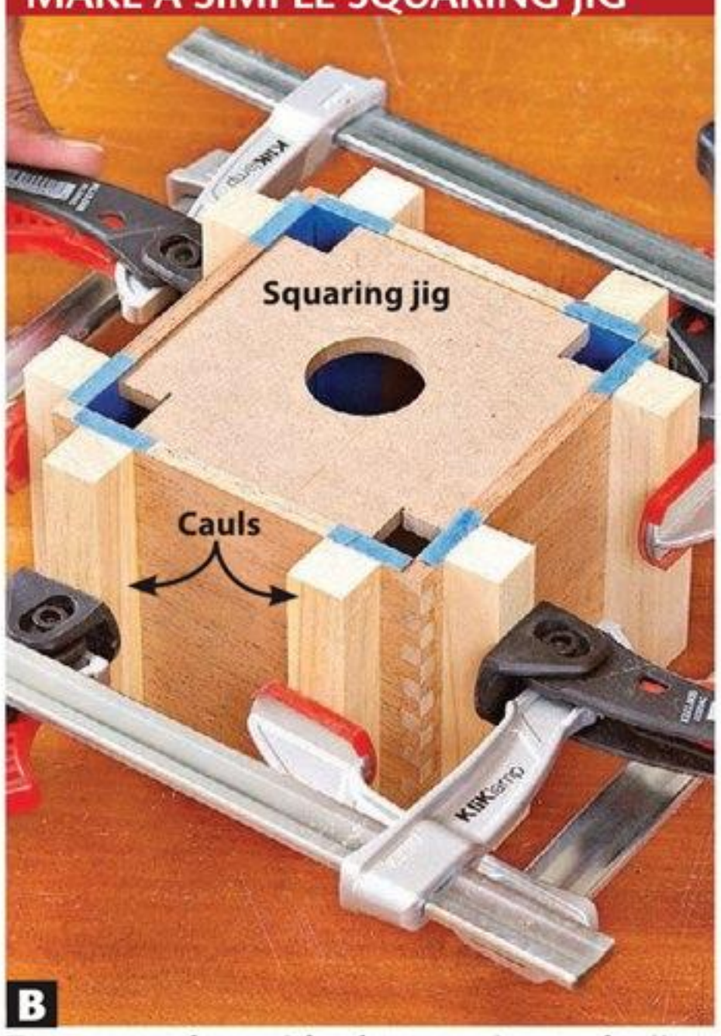
MAKE A SIMPLE SQUARING JIG



To square a box with a bottom, insert the jig into the top and clamp. Cauls beside—not on—the joints spread the clamping pressure.

Make a squaring jig sized to fit snugly within a box opening [**Photo B**], notching each corner to avoid glue squeeze-out.

For box joints, where the fingers stand proud during glue-up, use spacers or cauls, as shown in **Photo B**, to keep clamp pads off the joints. The same technique also works for clamping the proud ends of dovetails.

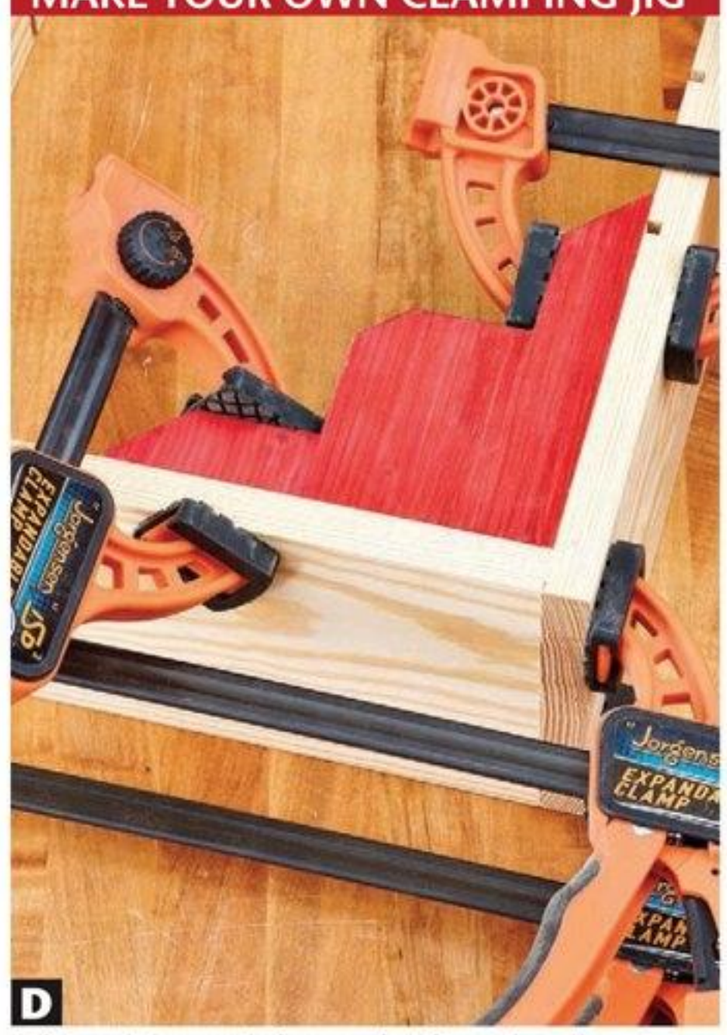
BRACES HOLD PARTS STEADY

A rounded outside corner helps this clamping square (see Sources) fit tight against both parts of the glue-up.

Brace yourself

To keep simple butt joints square and in perfect alignment, a metal clamping square [**Photo C**] holds project parts at a right angle while keeping one part from sliding past the mating part. Or if shop-built's more your thing, make your own right-angle clamping jigs [**Photo D**] to any size you desire. (See **More Resources**.)

MAKE YOUR OWN CLAMPING JIG



When sizing a right-angle clamping jig, adjust the notch sizes to accommodate the pads on your clamps.

Quick Tip: No braces? You can still prevent butt joints from sliding out of alignment. First apply glue to the end of one part; then rub the end against the second part to spread the glue. Separate the joint for about 10 seconds to let the glue surfaces become tacky and rub the parts together again. The added tack helps hold parts in place as you clamp.

SHOP TIP

A no-measure diagonal double-check

Even if you don't own a reliable square, you can still check for square by measuring between opposite corners on a project. If the diagonals measure the same—and the opposing sides are equal length—you know it's square. If clamps interfere with this measurement, or you're gluing up several identical assemblies, try this simple alternative. Cut two scrap strips, each a few inches longer than half the length of the diagonals. Then cut one tip of each strip to about a 30° angle. Hold the strips together with the angled ends in opposite corners and clamp them together. Using this as your gauge, measure the other diagonal to confirm a square glue-up. To equalize the distances, lightly clamp across the diagonal corners that are farther apart.

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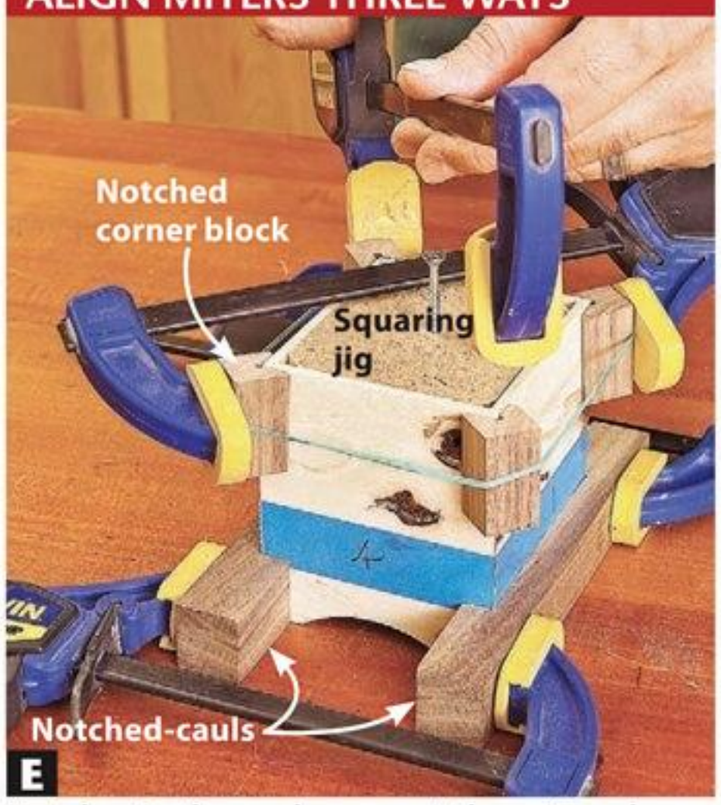
ALIGN MITERS THREE WAYS

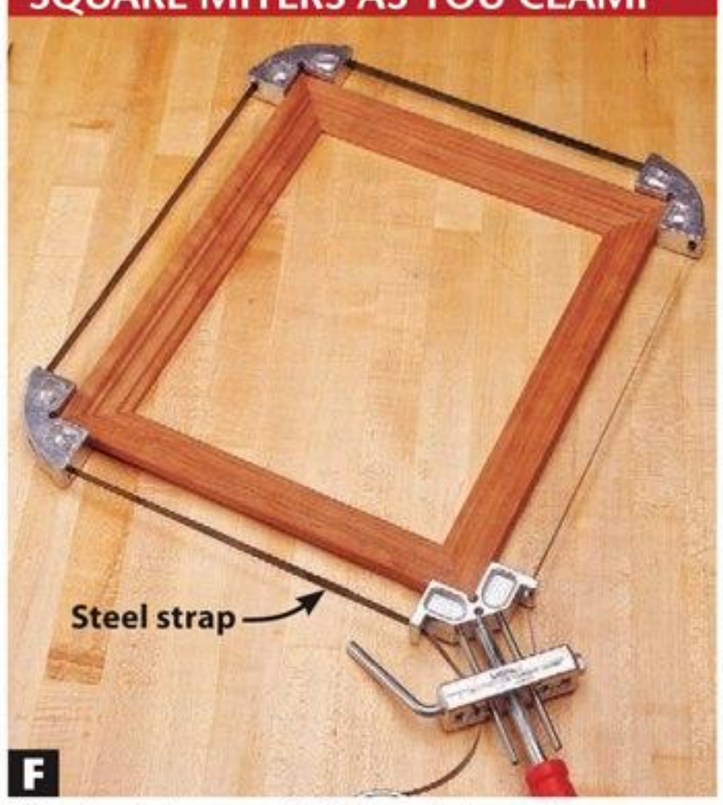


Notches in the cauls prevent the mitered box sides from spreading as corner blocks clamped diagonally hold the miters together.

Other shop-made squaring solutions include custom-sized, notched clamping cauls that hold parts in position at the same time they distribute clamping pressure [**Photo E**]. Also, V-notched corner blocks help pinch parts together at mitered corners.

Certain clamps have built-in advantages for square clamping. A band clamp with four 90° corners [**Photo F**] or a four-way frame clamp [**Photo G**], for example, help square all four corners of a glue-up at once.

SQUARE MITERS AS YOU CLAMP



The steel strap on this band clamp (see **Sources** *below*) distributes pressure to the four 90° corners, pulling the miters tight.

Sources

Band clamp: Merle Adjustable Clamp no. 9012, $28, MLCS, 800-533-9298, mlcswoodworking.com.
Four-way frame clamp: Veritas clamp no. 05F01.01, $28.50, Lee Valley Tools, 800-871-8158, leevalley.com.
Clamping squares: Pinnacle square no. 147530, $35 for two, Woodcraft, 800-225-1153, woodcraft.com.

CORNERS SQUARE BOX SIDES

Normally used for frame glue-ups, these four-way clamps can also be used in pairs for boxes. The corners help square the assembly.

MORE RESOURCES

FREE VIDEO
- "Tune-up Your Tablesaw" woodmagazine.com/tstuneup

FREE PLAN
- "Right-Angle Clamp Jig" woodmagazine.com/brace

RELATED ARTICLES
- "Fine-Furniture Accuracy from Any Tablesaw" issue 187 (November 2008) woodmagazine.com/tsaccuracy $
- "Tablesaw Tune-up Tips" issue 197 (May 2010) woodmagazine.com/tstuneuptips $

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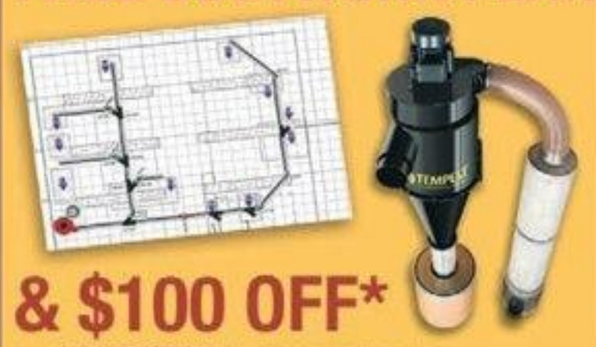

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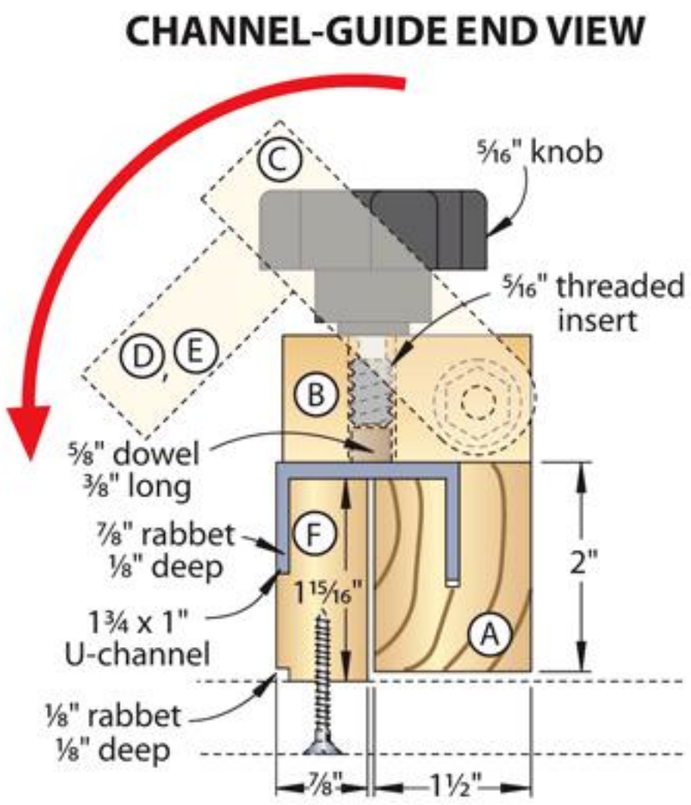
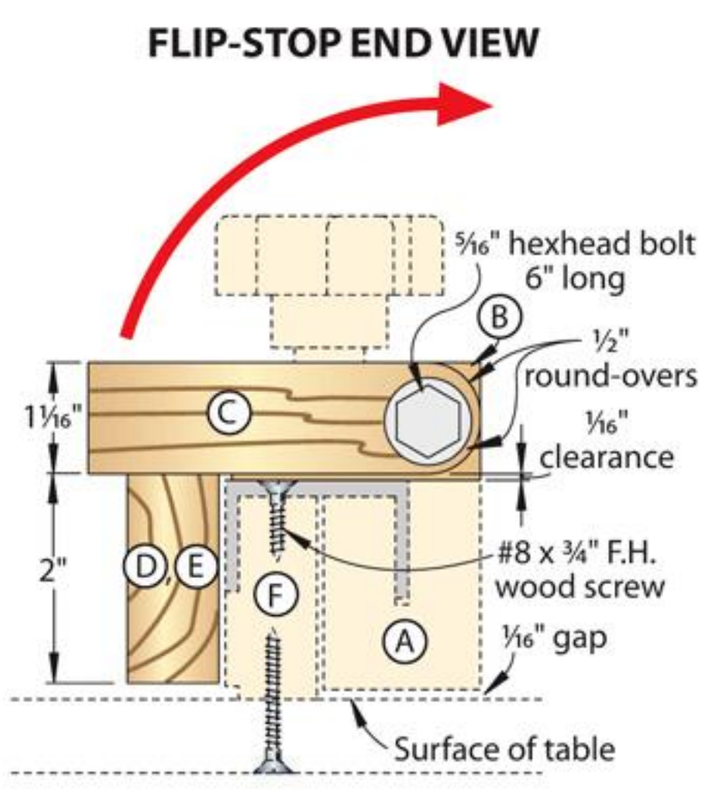
Cut all parts to size as detailed in the **Materials List** on *page 27*. For the length of the long stop (E), measure from the blade to the end of the metal mitersaw fence or saw table, whichever is longer, and add ¼". For the length of the fence rail (F), measure from the end of the mitersaw fence or table to the end of your mitersaw extension table. Assemble the pieces in the configuration shown in the drawing on *page 27*.

Use the short stop (D) when cutting longer pieces, and the long stop (E) when cutting shorter pieces where the guide won't slide close enough to the blade. The threaded inserts in the flipper (C) allow you to quickly change from one length of stop to the other.

We screwed the fence rail (F) directly





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to the top of the worksurface adjoining the saw, carefully aligning the inside edge of the U-channel with the metal fence on the saw.

Slide the stop onto the back edge of the U-channel, and position it where needed. Then, turn the knob to lock it in place.

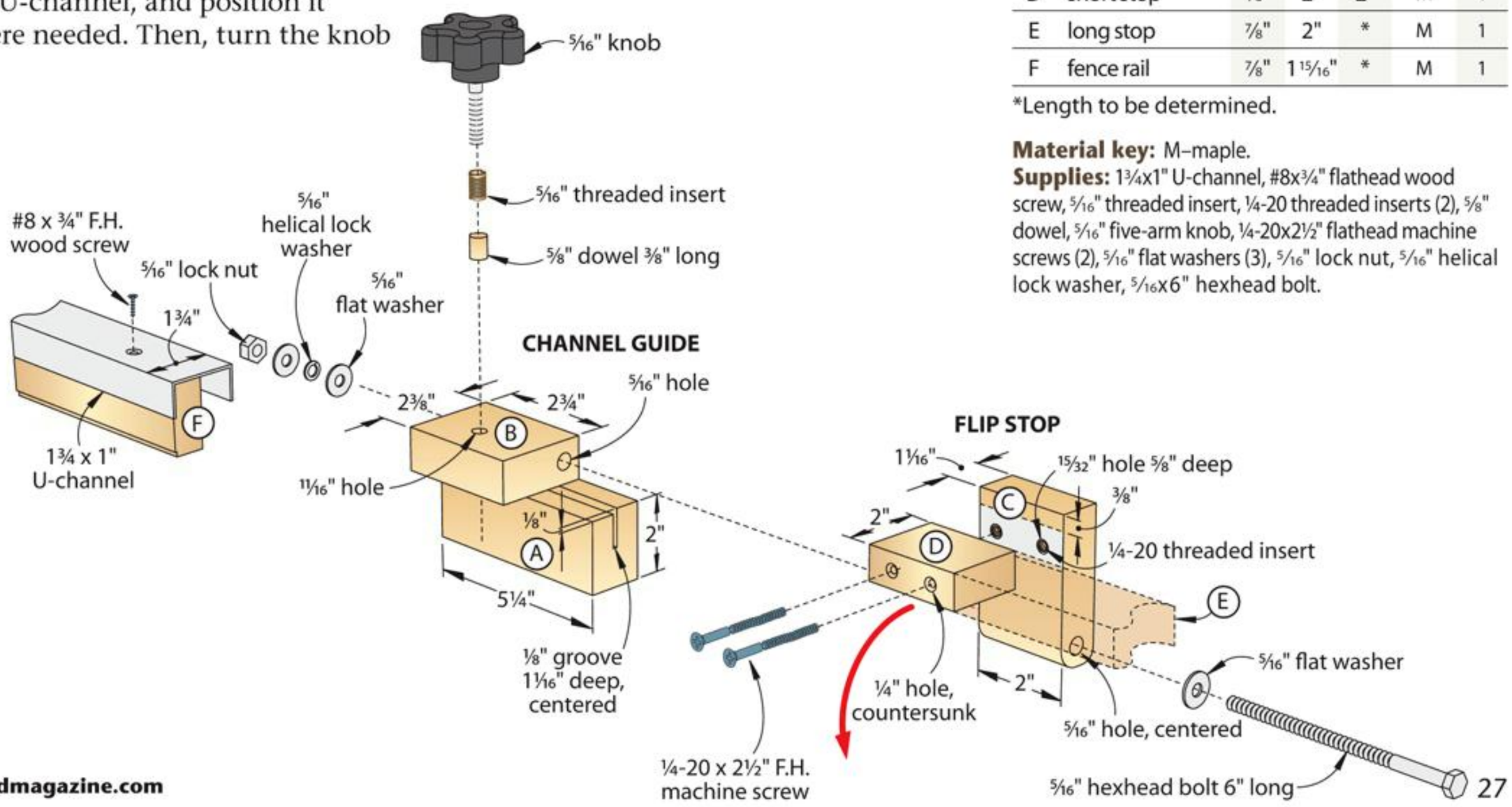
Project design: **Don Paterson,** Raleigh, N.C.

Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
A	body	1½"	2"	5¼"	M	1
B	channel guide	1⅛"	2⅜"	2¾"	M	1
C	flipper	1 1⁄16"	2"	3¾"	M	1
D	short stop	⅞"	2"	2"	M	1
E	long stop	⅞"	2"	*	M	1
F	fence rail	⅞"	1 15⁄16"	*	M	1

*Length to be determined.

Material key: M–maple.
Supplies: 1¾x1" U-channel, #8x¾" flathead wood screw, 5⁄16" threaded insert, ¼-20 threaded inserts (2), ⅝" dowel, 5⁄16" five-arm knob, ¼-20x2½" flathead machine screws (2), 5⁄16" flat washers (3), 5⁄16" lock nut, 5⁄16" helical lock washer, 5⁄16x6" hexhead bolt.



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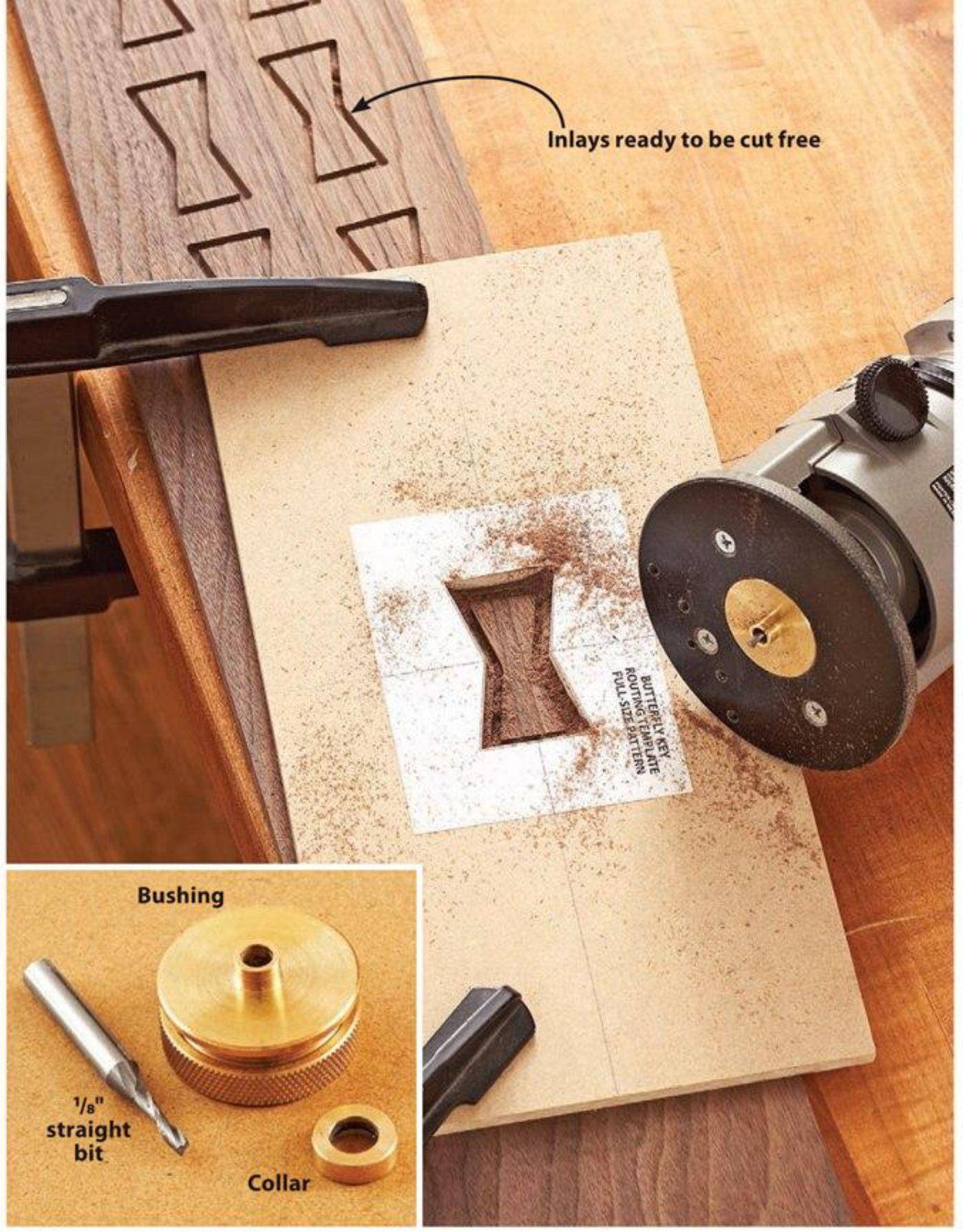


A simple router bushing kit (**inset photo** *right* and **Source** on *page 29*) makes it easy to add perfect-fitting inlays, such as the butterfly keys in the doors of the tool chest on *page 50*, to your projects. The kit consists of a bushing that fits into the subbase of your router, a collar that slips over the bushing, and a ⅛" straight bit. Once you understand how the kit works, turn your imagination loose to dress up your projects with accents in all sorts of shapes. Here's how.

Prepare a template

A shop-made template in the shape of your inlay guides the bushing. Make the template from ¼" hardboard and size the opening 7/16" wider and longer than the inlay to account for the distance between the cutting edge of the bit and the edge of the bushing. For example, the **Butterfly Key Routing Template** pattern from the *WOOD Patterns*® insert is 2 7/16" long, creating a 2"-long inlay. Size the template so you can clamp it to the workpiece with room for the router to move between the clamps. (Using a trim router allows for a smaller template.)

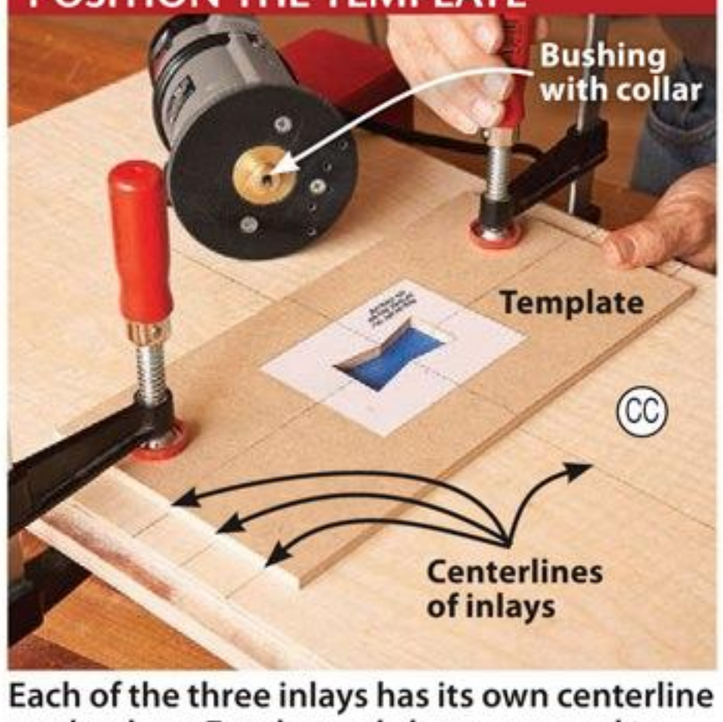
Draw centerlines on the template blank in both directions. Spray adhere your pattern to it, centered. At the scrollsaw, carefully cut out the inlay shape; then file and sand the edges of the cutout smooth.

Now lay out the centerlines of each inlay on the workpiece, as shown *below left*, extending the layout lines to the edges of the panel. Cover the inlay area with painter's tape to prevent chip-out when routing. Align the template and workpiece centerlines and clamp the template in place.

Rout the recess

Install the kit's guide bushing, collar, and bit in your router, and set the bit ¼" below the bushing. Rout away the

POSITION THE TEMPLATE

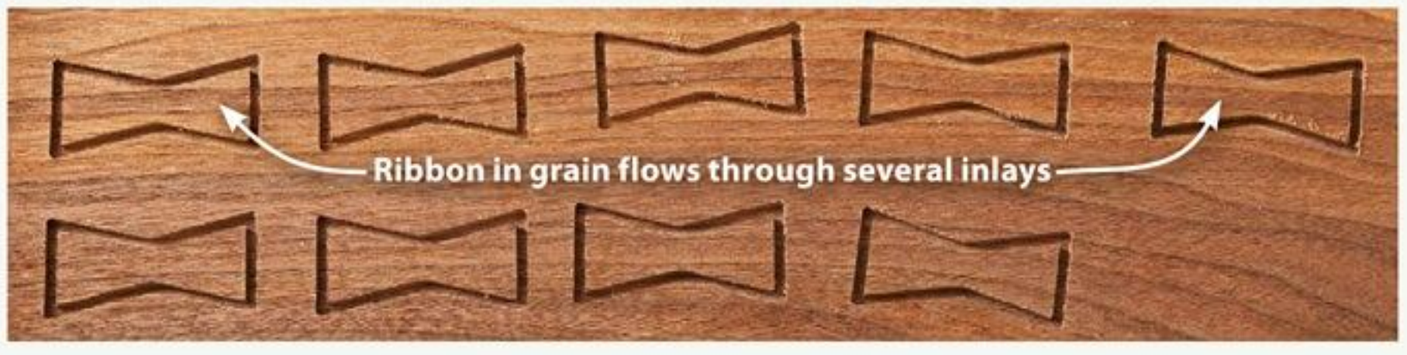


Each of the three inlays has its own centerline on the door. For the tool chest, we cut the butterfly pattern into a 6x12" template.

SHOP TIP

Follow the lines

Rotate the template as needed to align the desired grain in the opening. On these butterfly inlays, notice how the upper row centers a ribbon in the grain along the length of each inlay.



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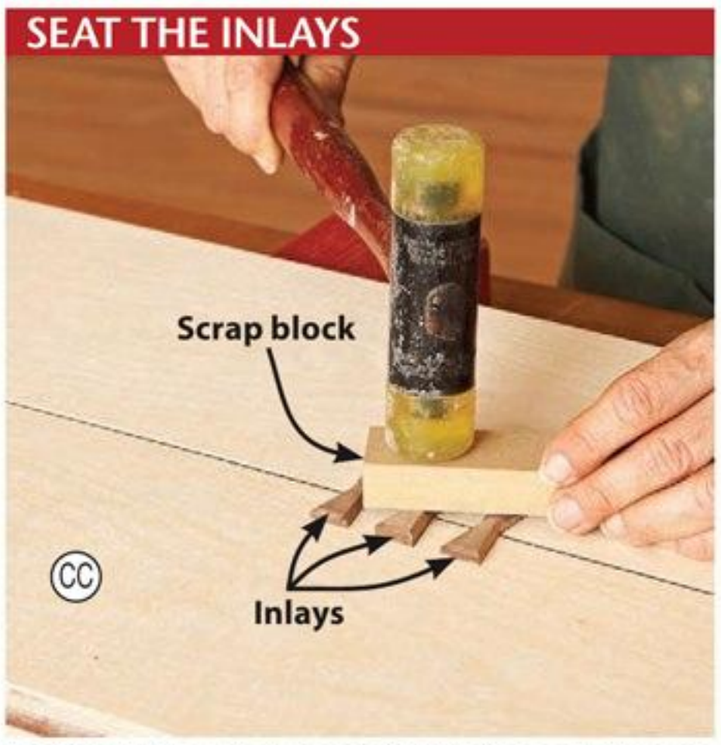

Apply a thin, even coat of glue to each recess. Cover the inlays with a scrap block and seat them with a few light blows from a mallet.

waste within the cutout. On the tool chest, we then moved the template to each remaining set of layout lines and repeated the process.

Carefully remove the painter's tape. ***Quick Tip! Prepare for liftoff.*** Peel the tape toward the opening to prevent lifting small chips of veneer. With a chisel, complete the angles at the corners of each recess.

Make the inlays

On the tool chest, the inlays stand proud of the door face, so we prepared a ⅜×5×24" walnut blank. (For inlays flush with the surface, prepare a 3/16"-thick blank.) Clamp the template to the blank [*opposite page, top right* and **Shop Tip**]. Remove the collar from the bushing, reset the bit height to 3/16" below the bushing and rout the inlays.

Note: *Keep the bushing tight to the template at all times. Any place it pulls away from the template creates a gap between the inlay and recess.* At the end of the cut, hold the router in place, shut it off, and allow the bit to stop before lifting the router.

Scrollsaw or bandsaw the keys from the blank, following the routed outline. Then clean up the edges with a chisel and file, slightly undercutting them to create a tight fit in the recess. On the tool chest, we sanded the top faces of the inlays to 220 grit, creating a 1/16" chamfer along the top edges.

Now glue and seat the inlays as shown *above*. For flush inlays, sand the inlay even with the surrounding surface after the glue dries.

Source: Router inlay kit no. 27593, $34.99, Rockler, 800-279-4441, rockler.com

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The JDS 2HP Cyclone is the most powerful and compact 2HP Cyclone in the industry. This unit is 68" tall and has a footprint of 40"x 28". The perfect size for basement shops and shops with limited space. The TEFC motor and "Turbo-Fan" impeller produces high amounts of CFM when placed under high amounts of resistance. Removing the steel drum is quick and easy, just lift up the drum lid lever and roll out the drum. The self cleaning 1 micron canister filter has a motor that automatically rotates flappers inside the filter knocking dust down into a collection bag.

Thwart Router-Bit Tear-out

A few simple tips prevent ragged runs on routed edges.

Tear-out—when a router bit rips chunks of wood from your workpiece instead of cleanly shearing it—happens more often in porous-grain wood species, such as red oak, ash, and hickory. But even tight-grained woods (maple, cherry, and walnut) can fall victim. A few simple precautions reduce or eliminate tear-out with any type of wood:

- Keep your router bits clean and sharp. A bit needs attention if it's consistently burning or tearing out wood.
- Choose the appropriate router speed. (See the chart at *right*.) Remember that small diameter bits (under 1") perform best at the top speeds, while large-diameter bits, such as panel-raisers, need the slowest speeds.
- Select wood with straight grain that runs the length of your project parts, especially for door frames. Wavy or figured grain or grain that runs diagonally across a workpiece's width proves more prone to tear-out.
- Feed tear-out-prone stock at a rate slower than you normally would—even if it burns the wood slightly. Then make a light final pass removing about 1/32" at a normal feed rate.
- Resist the temptation to take deep cuts. Instead, rout in 1/8"-deep increments.

Zero-clearance fence nets you zero tear-out

Like a zero-clearance tablesaw throat insert, a zero-clearance auxiliary fence for your router table supports wood fibers next to those being cut away. And it's easy to make one. We recommend ½"-thick medium-density fiberboard (MDF) for auxiliary fences because it's inexpensive, flat, smooth, and easy to work with.

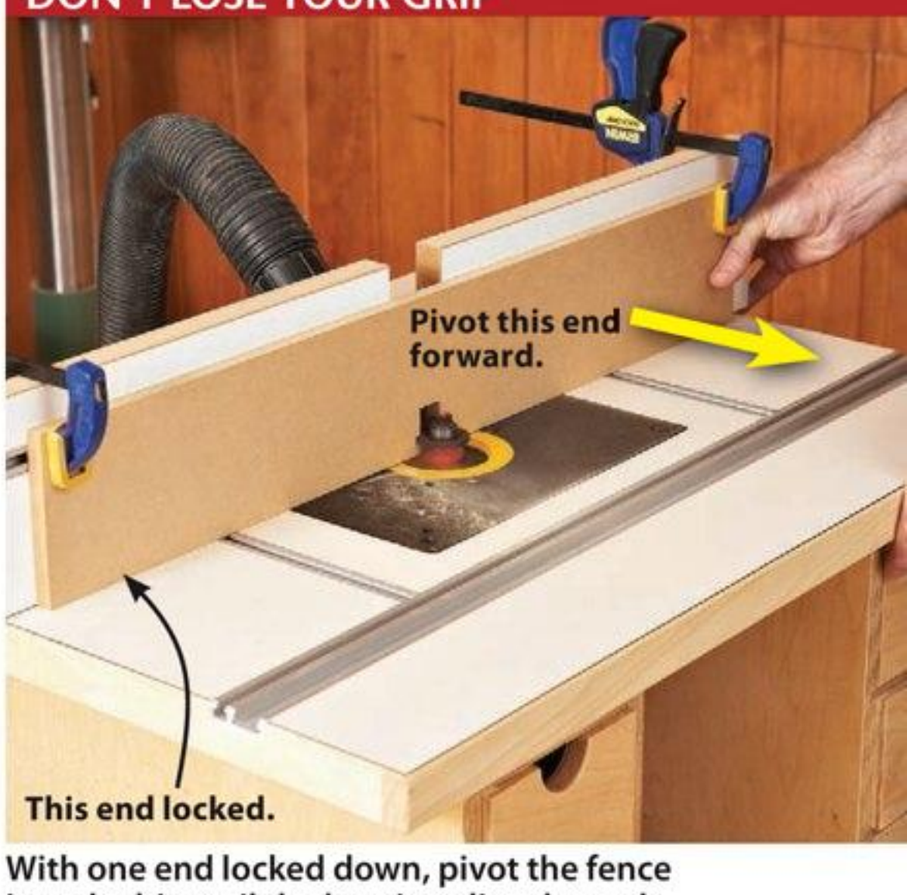
Begin by cutting out a blank about as long as your router table's fence. The blank height need only be taller than your bit by an inch or so, unless you're routing a large workpiece on edge and it needs the added support of a taller auxiliary fence.

With your bit installed in the router and set to the height of your final pass—you'll need to make test cuts in scrap before adding the auxiliary fence—hold the MDF blank against your fence and centered on the bit. For bits with a bearing, mark the width and height of the bearing (and its mounting

Router bit speed chart

Bit diameter	Max. speed × 1,000 rpm
up to 1"	24
1⅛–2½"	16–18
2⅝–3"	12–14
3⅛" or larger	10–12

DON'T LOSE YOUR GRIP



With one end locked down, pivot the fence into the bit until the bearing slips through the relief cutout and behind the MDF face.

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screw) on your MDF blank. Saw out a relief slot for the bearing. (Remember, you only need zero-clearance protection where the cutters meet the workpiece on the infeed side.)

Now, clamp the MDF blank to your fence. Position the fence behind the bit as close as possible without touching the bit, and secure one end. Turn the router on and slowly pivot the fence into the bit, as shown on *page 30*. Turn off the router and align the fence to the bit, as shown *below*.

Feather boards, or similar accessories, help to eliminate tear-out by holding stock tightly against the fence and table, as shown at the *bottom*. Without these, accidental lifting or jerking could cause the bit to tear away chunks from the profile.

NOW SET THE FENCE DEPTH

Align the auxiliary fence and the bit's bearing using a steel rule or other reliable straightedge to set the full depth of cut.

HELPING HANDS

Clamp on a feather board to hold the workpiece tightly against the table and another to keep it pressed against the fence.

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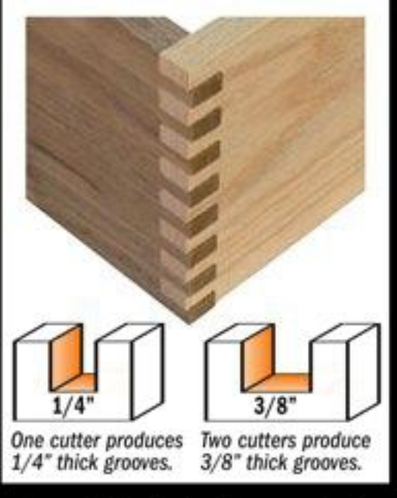

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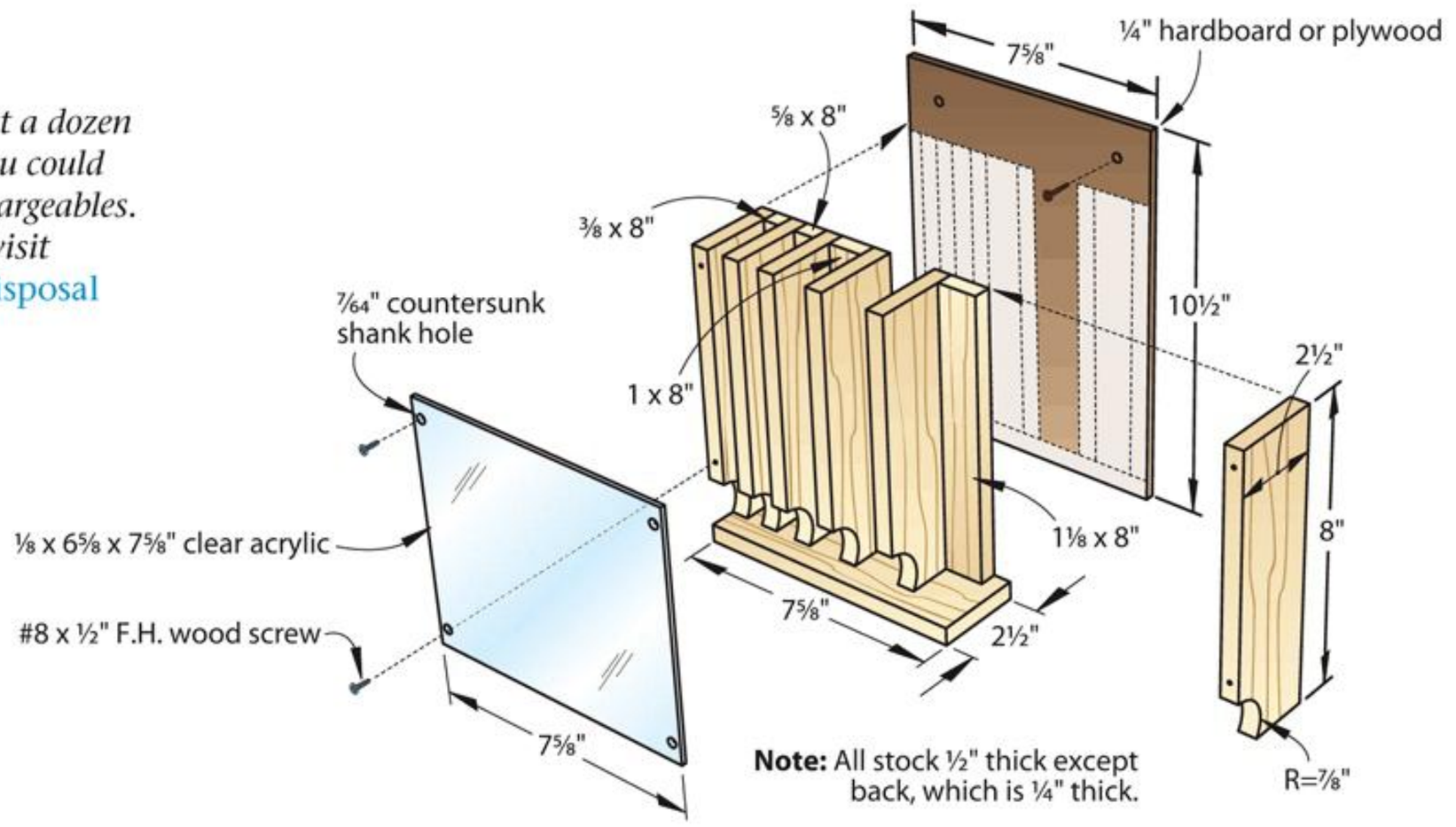
Project design: **Bob Hunter**



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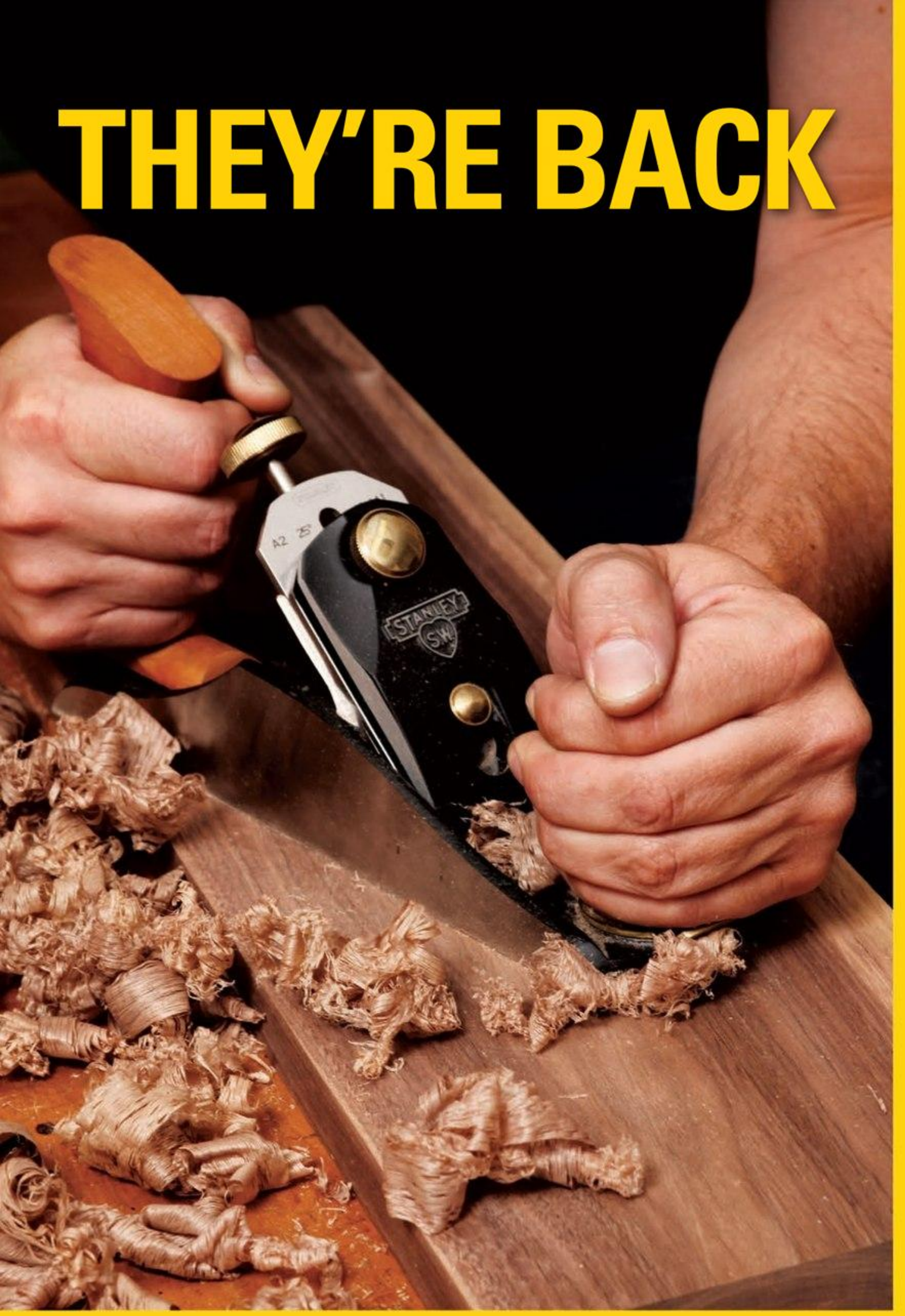
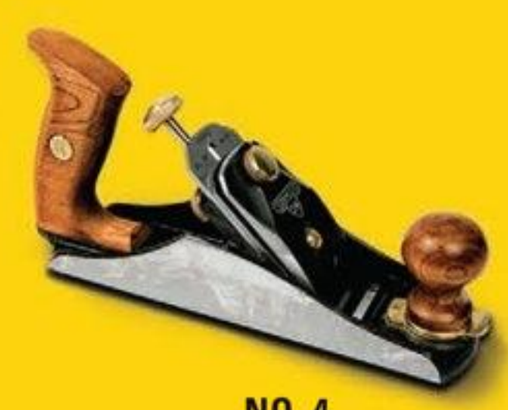
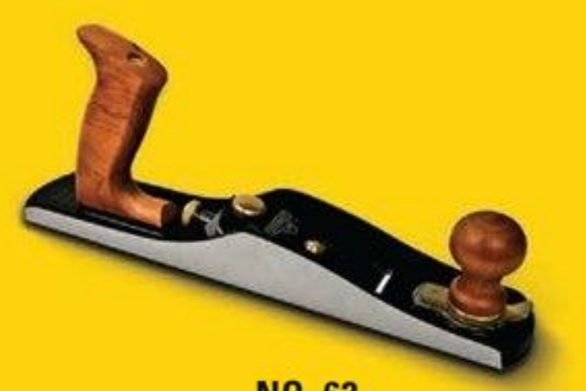




NO. 4
SMOOTHING PLANE



NO. 62
LOW ANGLE JACK PLANE

NO. 9 -1/2
BLOCK PLANE

NO. 60 -1/2
LOW ANGLE BLOCK PLANE

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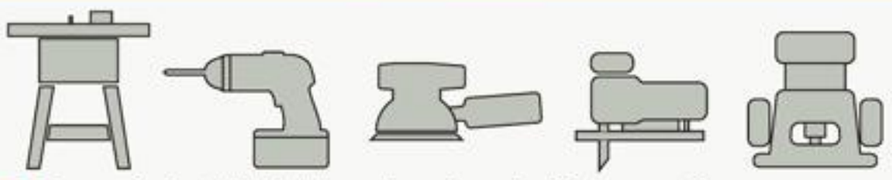

- **Materials:** ¾"-thick red oak, a half-sheet of ¾" oak-veneer plywood.

PROJECT HIGHLIGHTS

- Overall dimensions: 35½" long × 15 11/16" deep × 32¼" high.
- Learn how to drill dowel joints with pinpoint accuracy.

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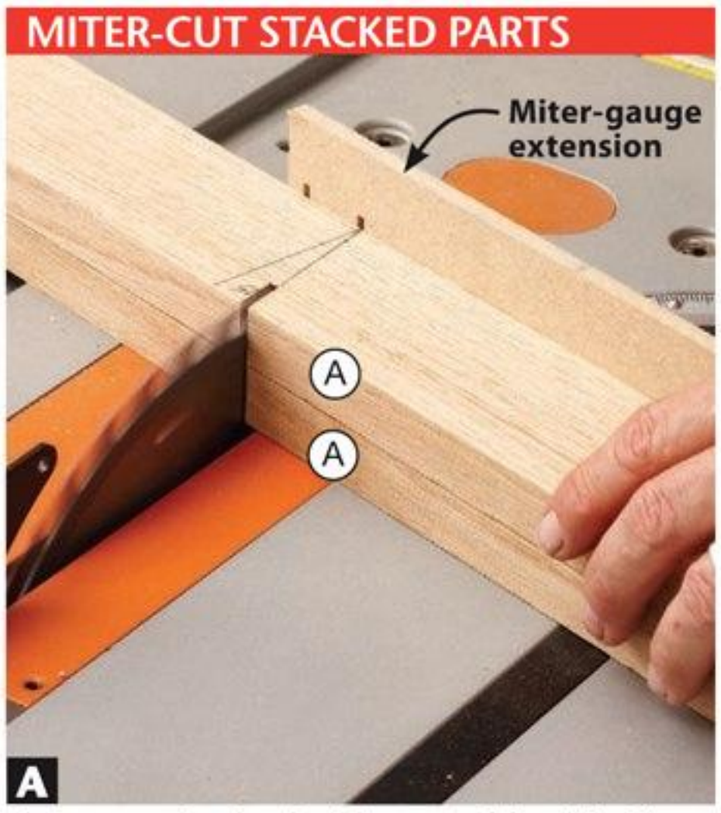
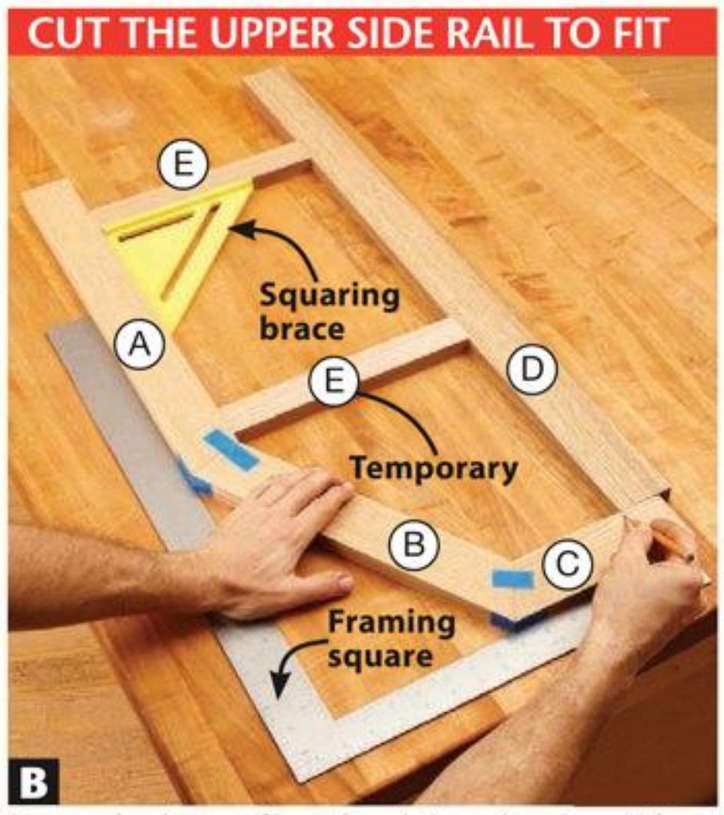
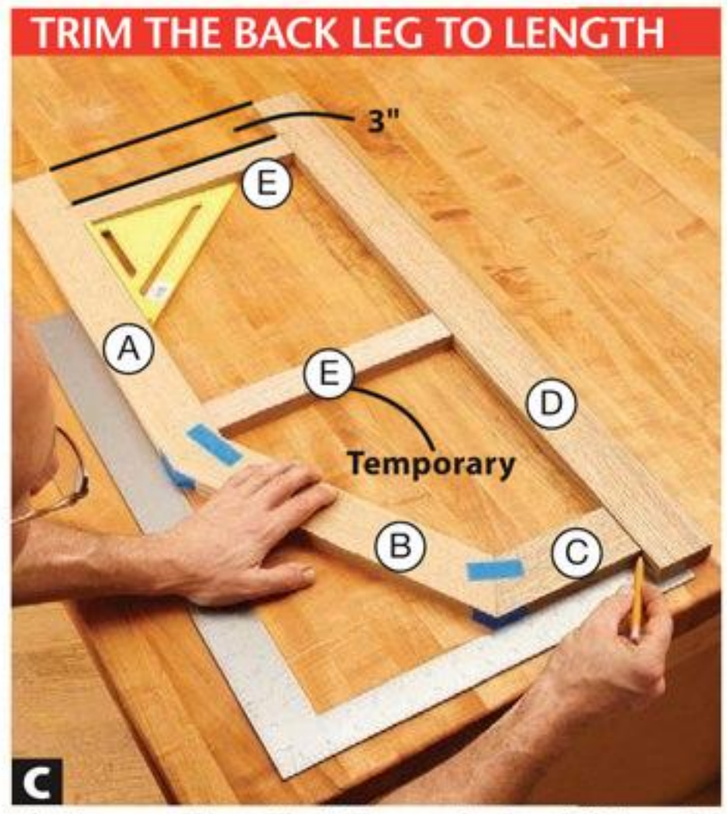


To ensure that both side assemblies (A–G) match, stack and saw identical parts at the same time.



Brace the lower front leg (A) and upper side rail (C) against a framing square while you mark the length of the upper side rail.



The lower side rails (E) keep the back (D) and lower front (A) legs parallel while you mark the back-leg length at the upper side rail (C).

This bookcase's angled shelf makes it easy to browse titles without bending, while the top and bottom shelves provide display space. Open sides make it light on its feet and a snap to build using common lumber.

Cut parts for both sides

1 Rip 2¼"-wide blanks long enough to crosscut the lower front legs (A), upper front legs (B), upper side rails (C), and back legs (D) 1" longer than shown [**Drawing 1**; **Materials List**, *page 38*]. Rip 1½"-wide blanks long enough to cut two lower side rails (E) to length and the long cross braces (F) and short cross braces (G) about ½" longer than shown.

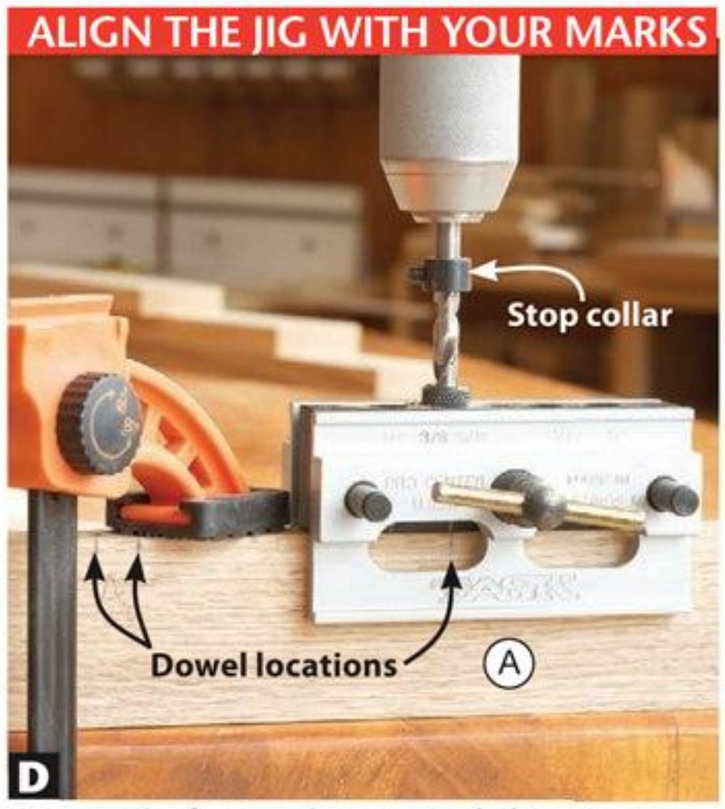
2 Set your miter gauge to cut a 15° angle, make test cuts in scrap, and confirm the angle with a protractor. Then miter-cut the lower front legs (A) to length [**Photo A**] and cut one end of the upper front legs (B).

3 Reset the tablesaw miter gauge for a 30° angle and miter-cut the top end of each upper front leg (B). Then miter-cut one end of the upper side rails (C), but leave it about 1" oversize in length.

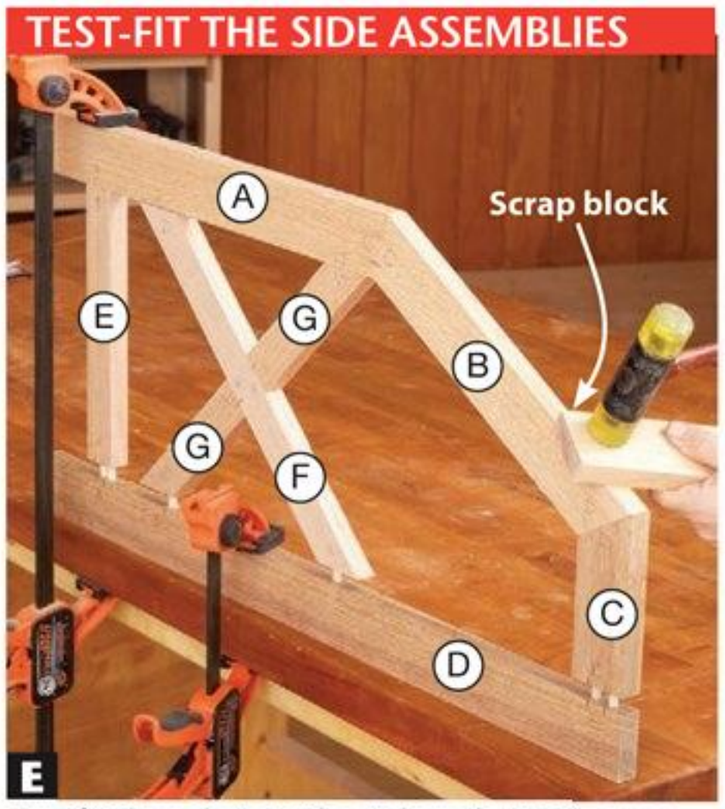
4 Tape together a lower front leg (A) and upper front leg (B), and upper side rail (C) [**Photo B**]. Butt *both* lower side rails (E) against the lower front leg and press the back leg (D) against their ends. Then mark where the upper side rail intersects the back leg and cut the upper side rail to length.

5 Replace the upper side rail (C) and hold the back leg (D) against the two lower side rails (E) [**Photo C**]. Use the upper side rail to mark the back-leg length and cut it to size. Repeat the previous step and this one to cut parts for the opposite side.

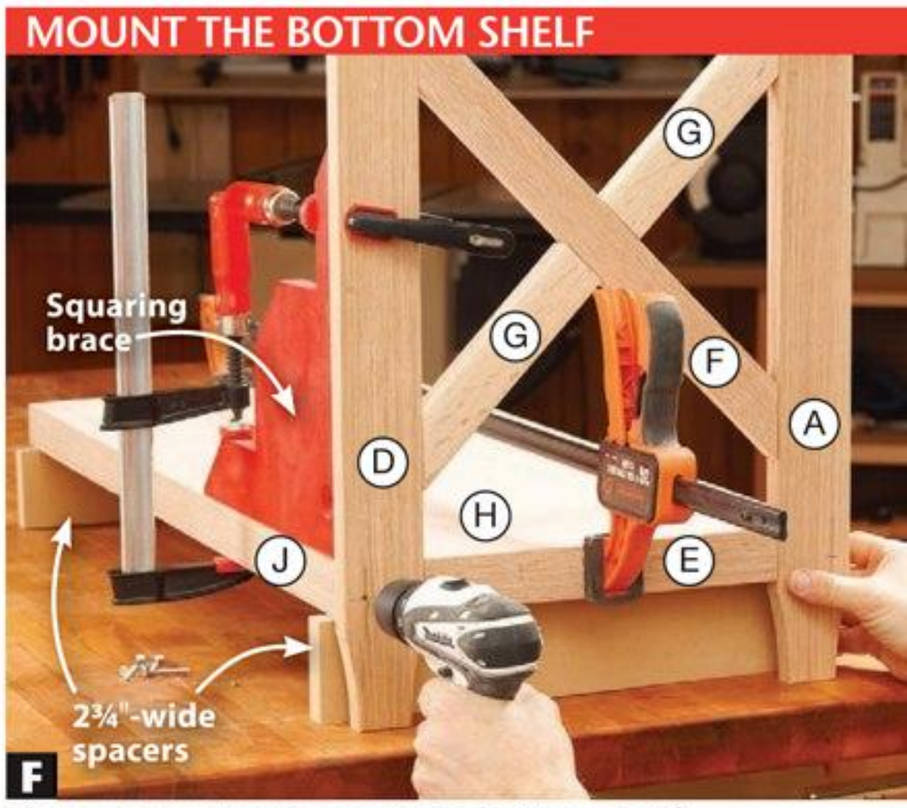
1 SIDE ASSEMBLY



Fine marks from a sharp pencil align more accurately with hole locations on the jig. A stop collar prevents drilling holes too deep.



Dry-fit dowels into the side rails (C, E), cross braces (F, G) and back leg (D). Check for gaps and sand the miters to adjust the fit.



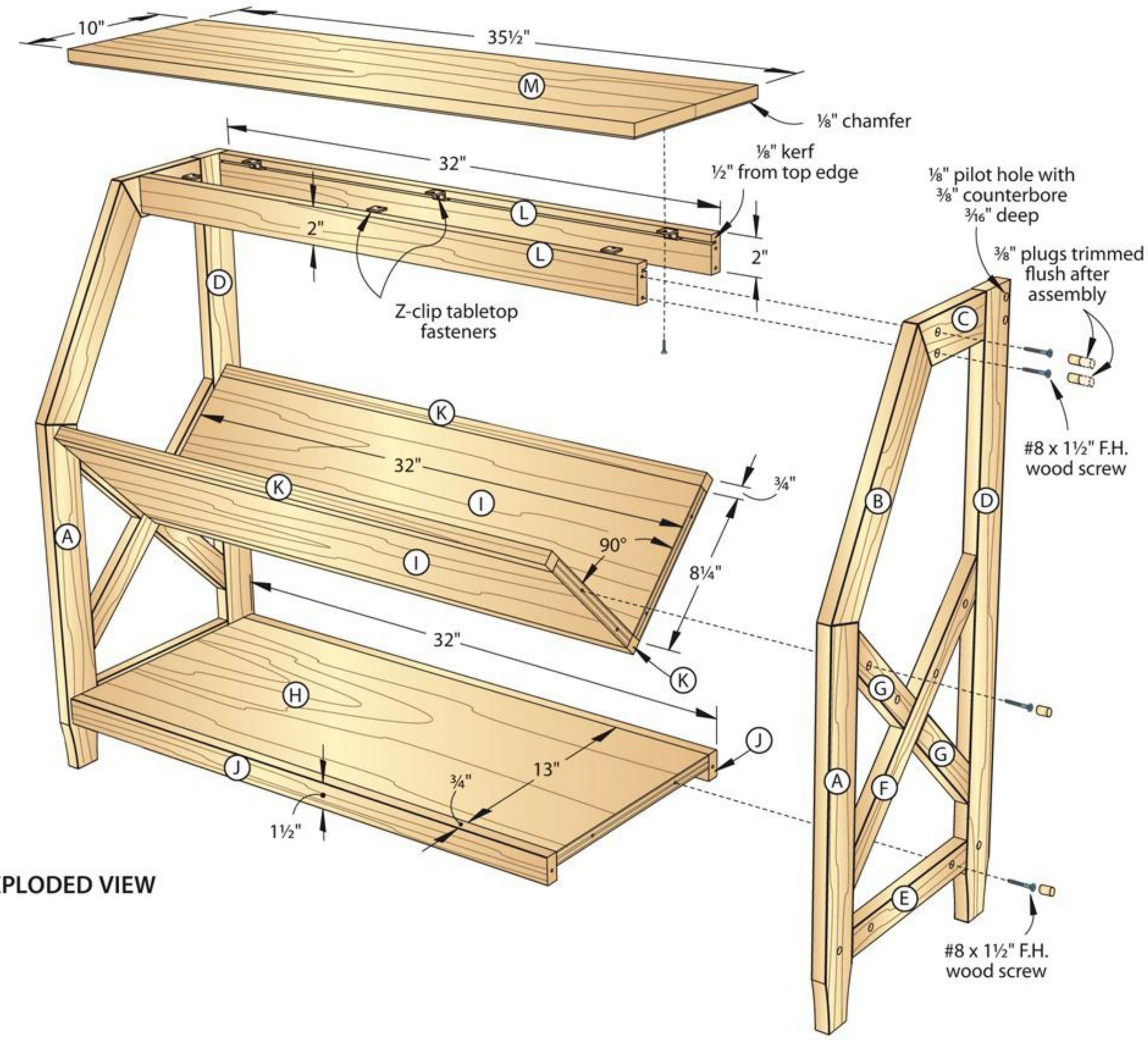
Clamp a squaring brace to the bottom shelf (H/J) and side assembly (A–G) to steady it while you drill counterbored pilot holes.

6 Stack and crosscut two long cross braces (F) to length. Then cut 45° miters on both ends [**Drawing 1**] of the stacked cross braces without reducing their total length.

7 Stack and miter-cut one end of each short cross brace (G). Then gradually crosscut them to length so that they align with each other across the width of the long cross braces.

Assemble the sides

1 Dry-fit the side-assembly (A–G) parts using painter's tape to hold them together and gently place them on your workbench. Mark the dowel-hole loca-



2 EXPLODED VIEW

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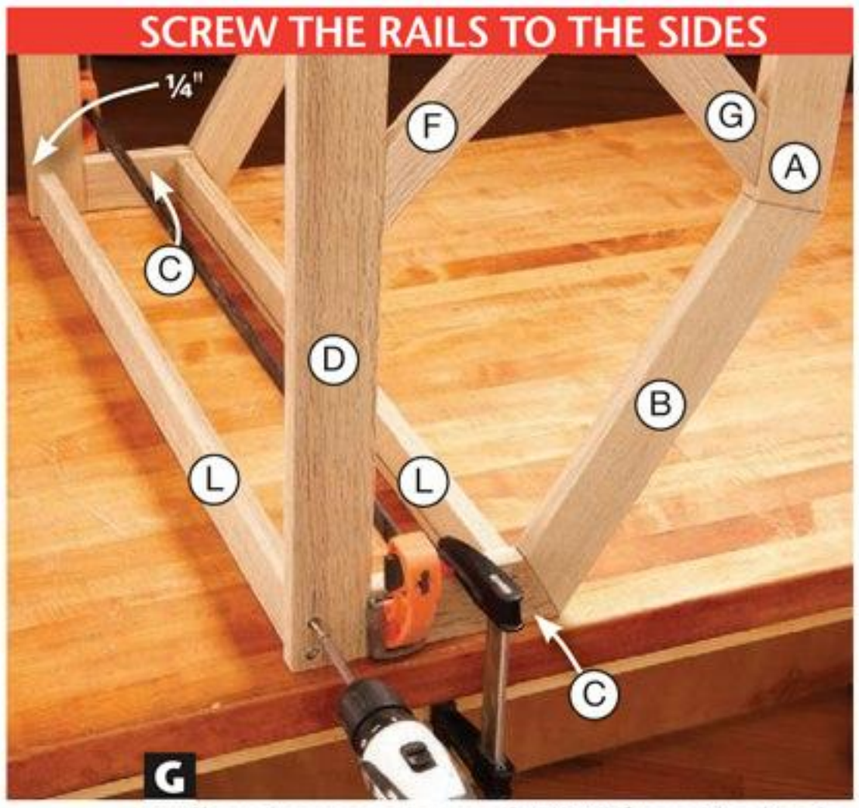
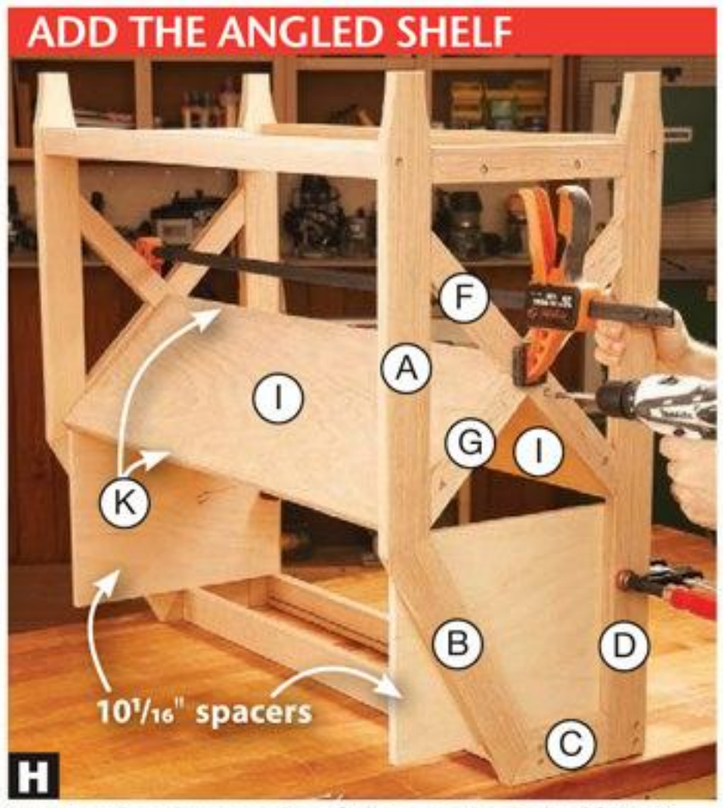
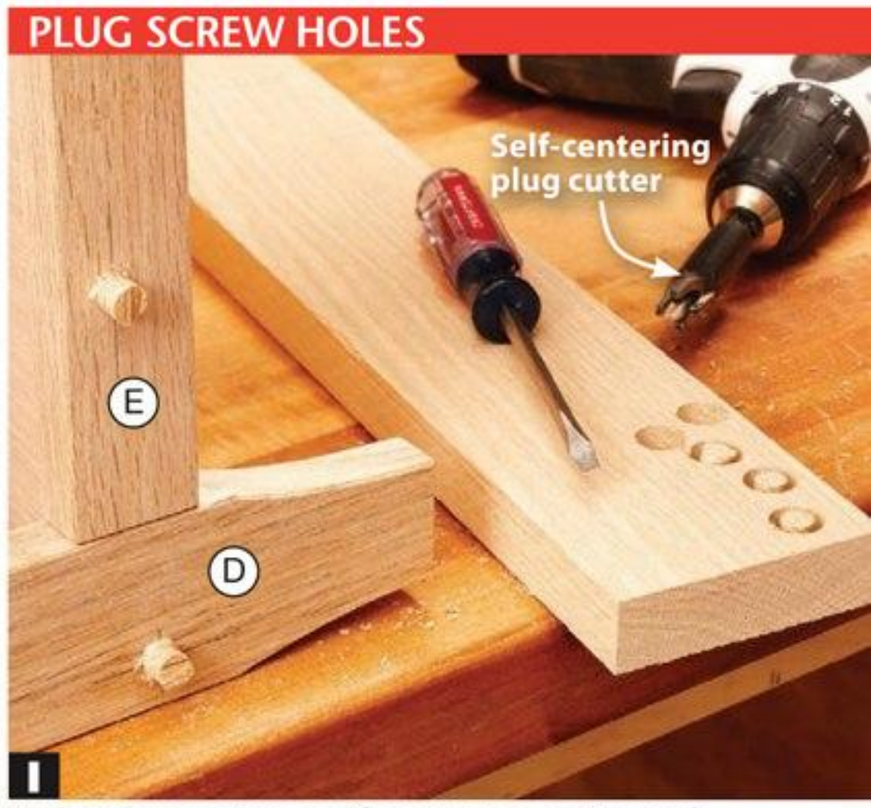


Drill and screw a top rail (L) ¼" from the back-leg (D) edges. Mount the front top rail 5⅛" from the back rail (L).



Center both panels of the angled shelf (I/K) on the width of the cross braces (F, G) while resting the shelf on spacers.



Make plugs using a self-centering cutter and pry them loose. Match the grain direction on the plug with the grain on each part.

tions for each joint as shown in the **Shop Tip** *below*. To reassemble parts as you have them laid out, mark each joint with a letter and remove the tape.

2 Install a stop collar on a 5/16" drill bit so that the bit extends beneath your doweling jig enough to drill 1⅛"-deep holes. Drill dowel holes where marked [**Photo D, Drawing 1**]. (See the **Shop Tip** *far right* for a safe way to drill short pieces.)

3 Dry-assemble each side (A–G) to check the dowel-hole alignments [**Photo E**]. ***Quick Tip! Don't force the fit.*** If any dowels don't slide easily into their holes, lightly sand them with 120-grit abrasive until they fit using moderate pressure. Disassemble the sides and carefully remove the dowels.

4 Make four copies of the **Leg Bottom Pattern** from the *WOOD Patterns®* insert and adhere them to the legs (A, D) with spray adhesive. Jigsaw on the waste side of the pattern line and then sand to the pattern lines. Sand the side parts A–G to 220 grit and chamfer the edges.

Quick Tip! Eased edges ease assembly. Hand-sand a 1/16" chamfer on all edges of each part to help deemphasize minor gaps at the joints.

5 Glue the dowels and the joint faces sparingly to avoid squeeze-out; then assemble the sides (A–G). Finish-sand as needed to 220 grit.

Make and install the shelves

1 Cut all shelf panels (H, I), shelf trim (J, K), and top rails (L) to size. Glue and clamp the shelf trim to the shelves [**Drawing 2**], with two pieces of trim attached to the front angled shelf panel. Sand the trim pieces flush with the plywood. Then glue and clamp the two angled shelf panels and check for square.

2 Saw kerfs on the inside faces of the top rails (L) to accept the Z-clips. (We cut a ⅛" kerf ½" from the top edge.) Sand the rails to 220 grit.

3 Cut two 2¾×16" spacers from scrap and rest the bottom-shelf assembly (H/J) on the spacers [**Photo F**]. Drill counterbored pilot holes in the legs and screw the bottom shelf to the sides. (For a combination bit that drills both the pilot hole and countersink/counterbore, see **Sources** on *page 38*.)

4 With the project turned upside down on your bench, clamp the top

SHOP TIP

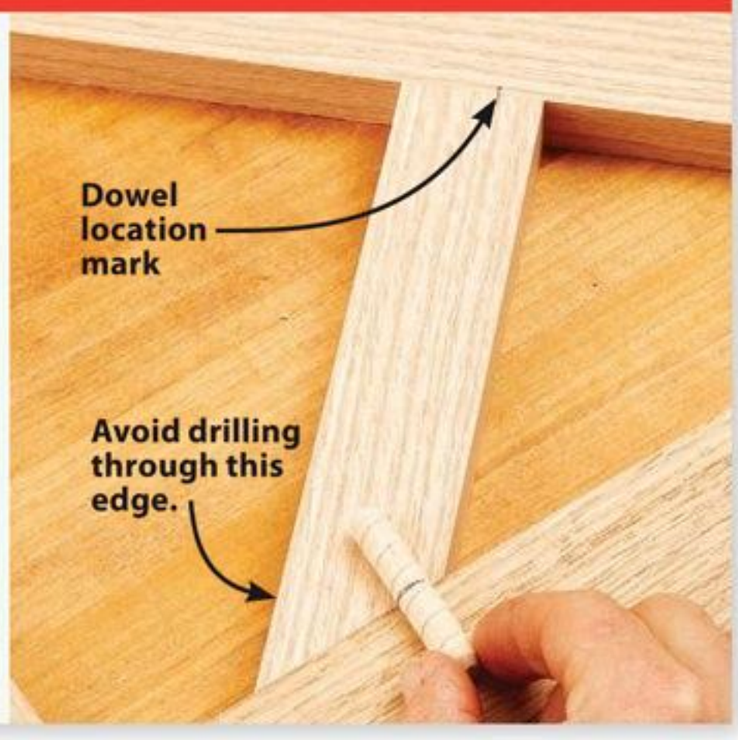
Make short work of drilling small parts

Holding a short piece steady when drilling dowel holes can be a problem, especially if your bench lacks a vise. Here's an easy work-around: Mount the doweling jig to the workpiece and then clamp the workpiece near the corner of the bench, as shown, to help keep the jig from accidentally rocking as you drill. For a mitered end, flip the workpiece so that the miter faces up and then mount your doweling jig.

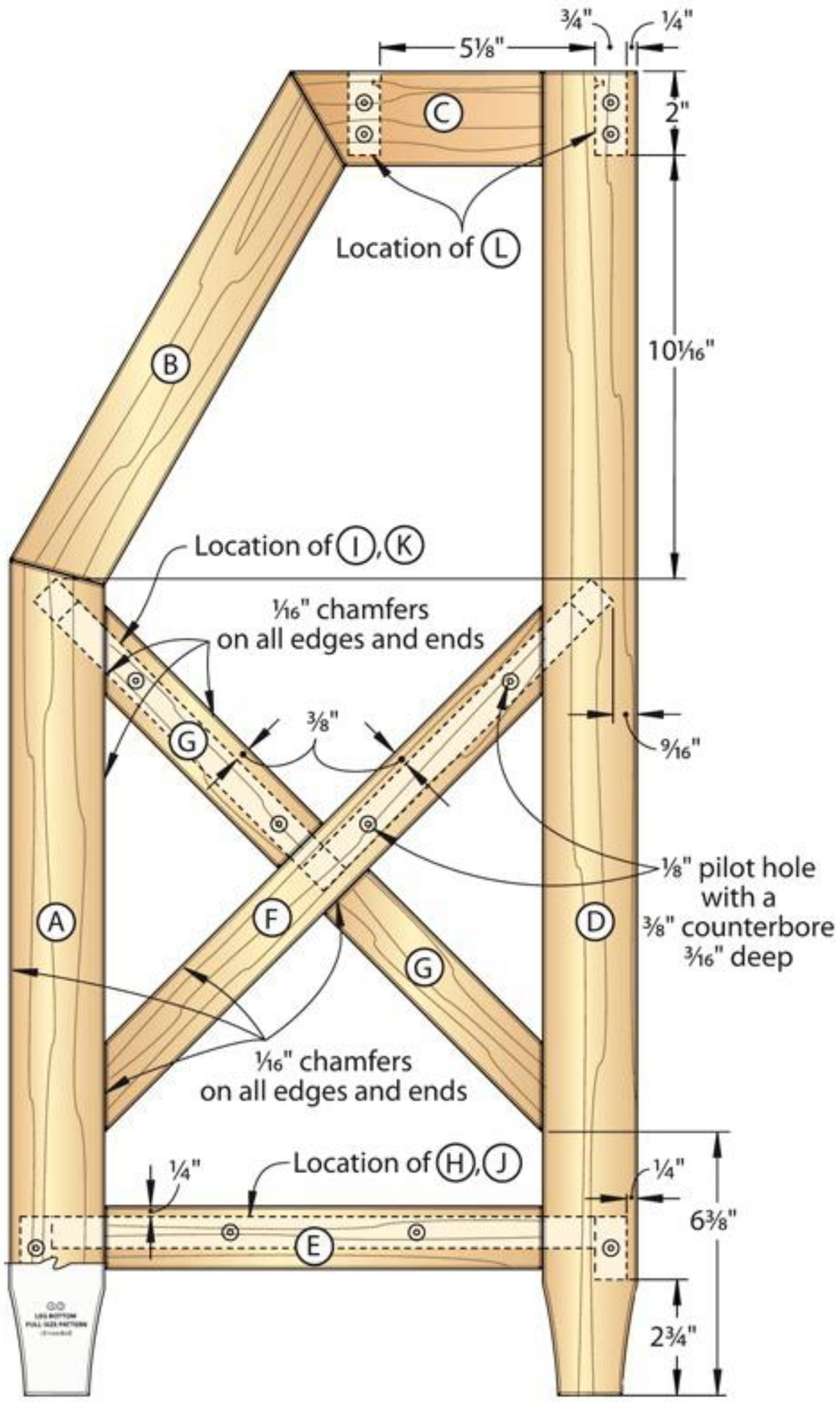
SHOP TIP

Double-check dowels

A fraction of an inch can make the difference between a dowel hole that does the job and one that pokes through one edge at a mitered corner. To avoid any problems, mark the center of a dowel and hold it in position over the joint. Reposition the dowel until you have at least ¼" of workpiece beyond each end of the dowel. Then mark the dowel location across the joint using a sharp pencil.



3 SHELF-MOUNTING LOCATIONS



rails (L), with the kerfs facing inward, between the sides (A–G) [**Photo G**]. Drill counterbored mounting holes and screw the rails to the sides.

5 Cut two 10⁹⁄₁₆"-wide spacers from scrap. With the project still upside down on your bench, stand the spacers on the top rails (L) and against the sides (A–G). Lay the angled shelf (I/K) [**Photo H**] on the spacers so it's centered on the cross braces (F, G) [**Drawing 3**]. Drill counterbored holes and screw the angled shelf to the sides.

6 Edge-glue pieces for the top (M) and cut to size. Rout a ⅛" chamfer around the bottom edges and sand to 220 grit.

7 Use a self-centering plug cutter to make ⅜" plugs to cover the screw holes. Then glue and tap them in place [**Photo I**]. Without marring the surrounding wood, saw or chisel the plugs flush and finish-sand them to 220 grit. Apply the stain of your choice (we used Minwax Ebony no. 2718) and allow it to dry. Then apply three coats of a wipe-on satin polyurethane, sanding with 320-grit abrasive between coats.

8 Rest the project upside down and centered on the top (M). Drill and screw Z-clips to the top. Your bookcase is ready to be loaded with your favorite reading materials and collectibles.

Produced by **Bob Wilson** with **Jeff Mertz**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine; Lorna Johnson**

Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
A*	lower front legs	¾"	2¼"	19⅞"	O	2
B*	upper front legs	¾"	2¼"	13⅜"	O	2
C*	upper side rails	¾"	2¼"	6"	O	2
D*	back legs	¾"	2¼"	31½"	O	2
E	lower side rails	¾"	1½"	10⁷⁄₁₆"	O	2
F*	long cross braces	¾"	1½"	16¼"	O	2
G*	short cross braces	¾"	1½"	7⅜"	O	4
H	bottom shelf panel	¾"	13"	32"	OP	1
I	angled shelf panels	¾"	8¼"	32"	OP	2
J	bottom shelf trim	¾"	1½"	32"	O	2
K	angled shelf trim	¾"	¾"	32"	O	3
L	top rails	¾"	2"	32"	O	2
M*	top	¾"	10"	35½"	EO	1

*Parts initially cut oversize. See the instructions.

Materials key: O–red oak, OP–oak-veneer plywood, EO–edge-glued oak.
Supplies: Spray adhesive, 5⁄16" dowel pins 2" long (32), #8×1½" flathead wood screws (24).
Bits: ⅛", 5⁄16", ⅜" drill bits; 45° chamfer router bit.

Cutting Diagram

¾ x 48 x 48" Oak plywood

Sources

Tabletop fasteners: Z-clip tabletop fasteners no. 34215, $2.09 for 8, Rockler, 800-279-4441, rockler.com.
Doweling jig: Deluxe jig no. 811565, $57, Woodcraft, 800-225-1153, woodcraft.com, or at many home centers.
Combination countersink and pilot hole bit: #8 tapered countersink bit no. 38068, $19.99, Rockler.
Self-centering plug cutter: ⅜" plug cutter no. 31115, $17.99, Rockler.

MORE RESOURCES

FREE VIDEO

- Basic Finishing (in three parts) woodmagazine.com/basicfinish.

RELATED ARTICLES

- "6 Steps to Perfect Plugs" issue 149 (June 2003) woodmagazine.com/woodplugs. $
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GENERAL INTERNATIONAL

Greene & Greene-style Clock

This handsome timepiece brings back the look of a bygone era.

Dimensions: 11¼"W × 4¾"D × 5⅜"H Shown with pine-landscape Motawi tile.

The delicate mahogany grain on this classic clock allows your eye to focus on the decorative handmade tile and swinging pendulum. Choose from one of the three looks shown here, then order a kit with the clockworks and the tile or panel you prefer [**Source,** *page 44*]. Or order just the clockworks and add your own tile.

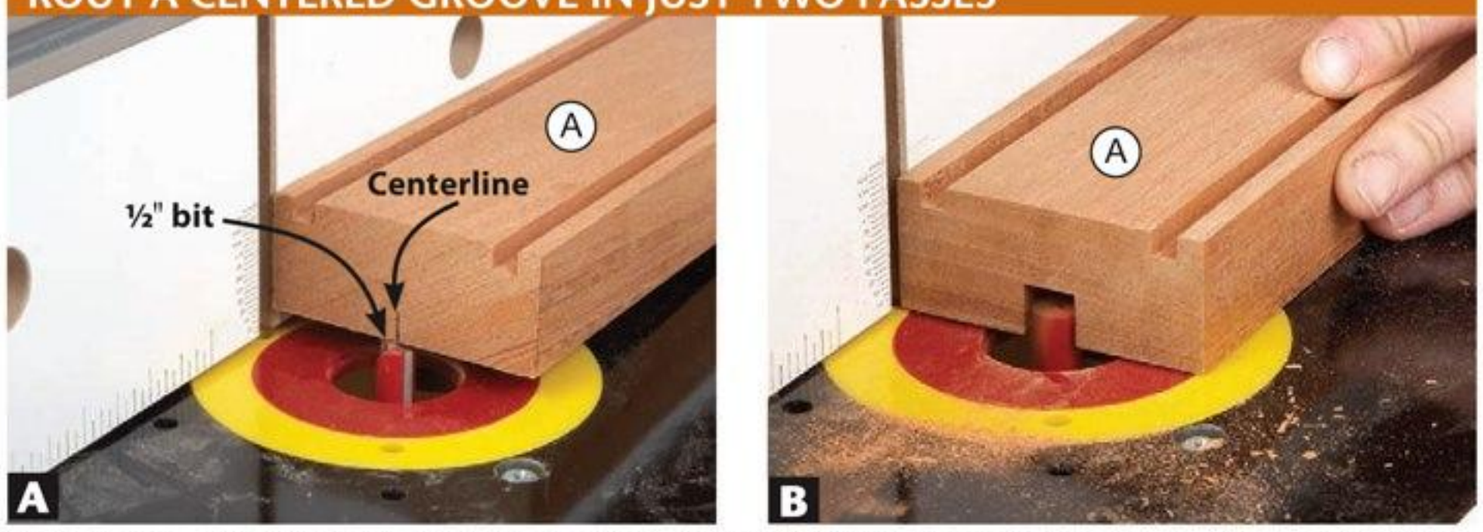
Gamble House Motawi tile

Hammered copper panel

Make your case

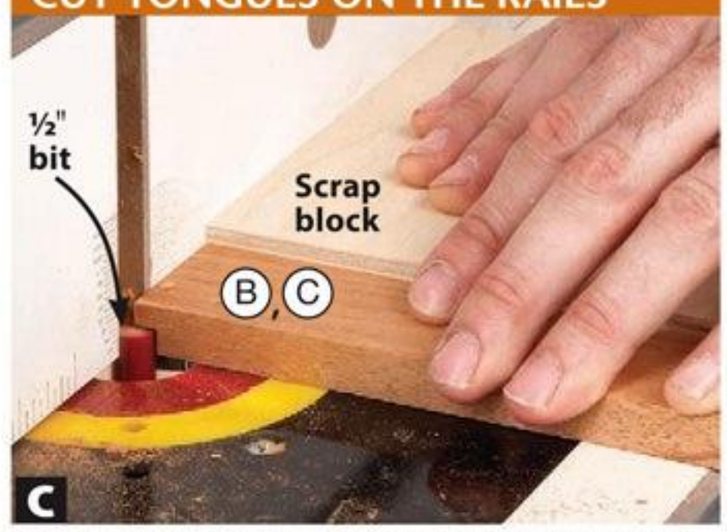
1 From 1¼"-thick stock, cut the sides (A) to size [**Drawing 1; Materials List,** *page 44*]. Mount a ¼" straight bit in your table-mounted router and rout the ¼"-deep grooves on the inside face of each side. Switch to a ½" straight bit in the router, and center a groove in the outside face [**Photos A, B**], raising the bit over the course of several passes. Sand the 1/16" roundovers where indicated.

ROUT A CENTERED GROOVE IN JUST TWO PASSES



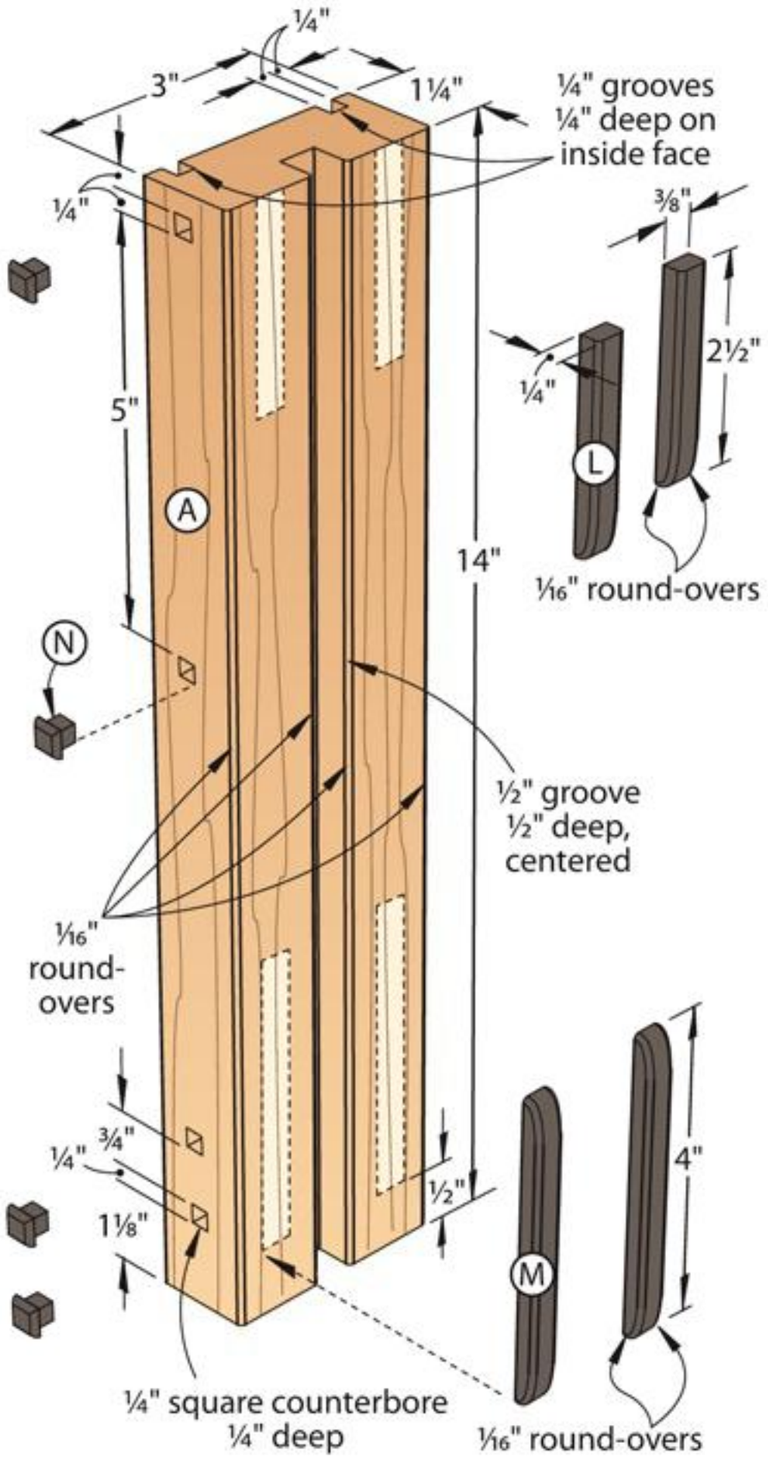
Mark the center of a side's (A) width, *above*. Center this mark by eye on the bit. Make a pass with one edge against the router-table fence. Flip the piece around and rout with the opposite edge against the fence, *above right*. A centered groove is more important than the precise width.

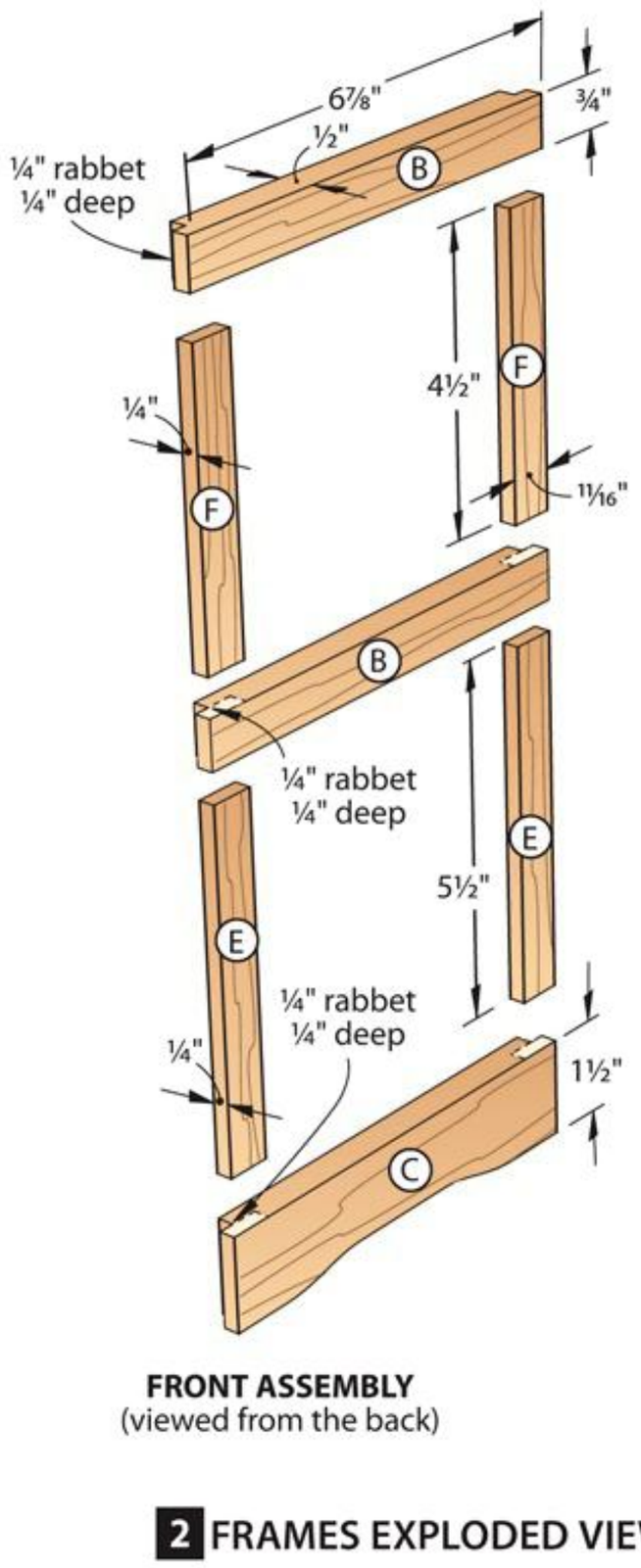
CUT TONGUES ON THE RAILS



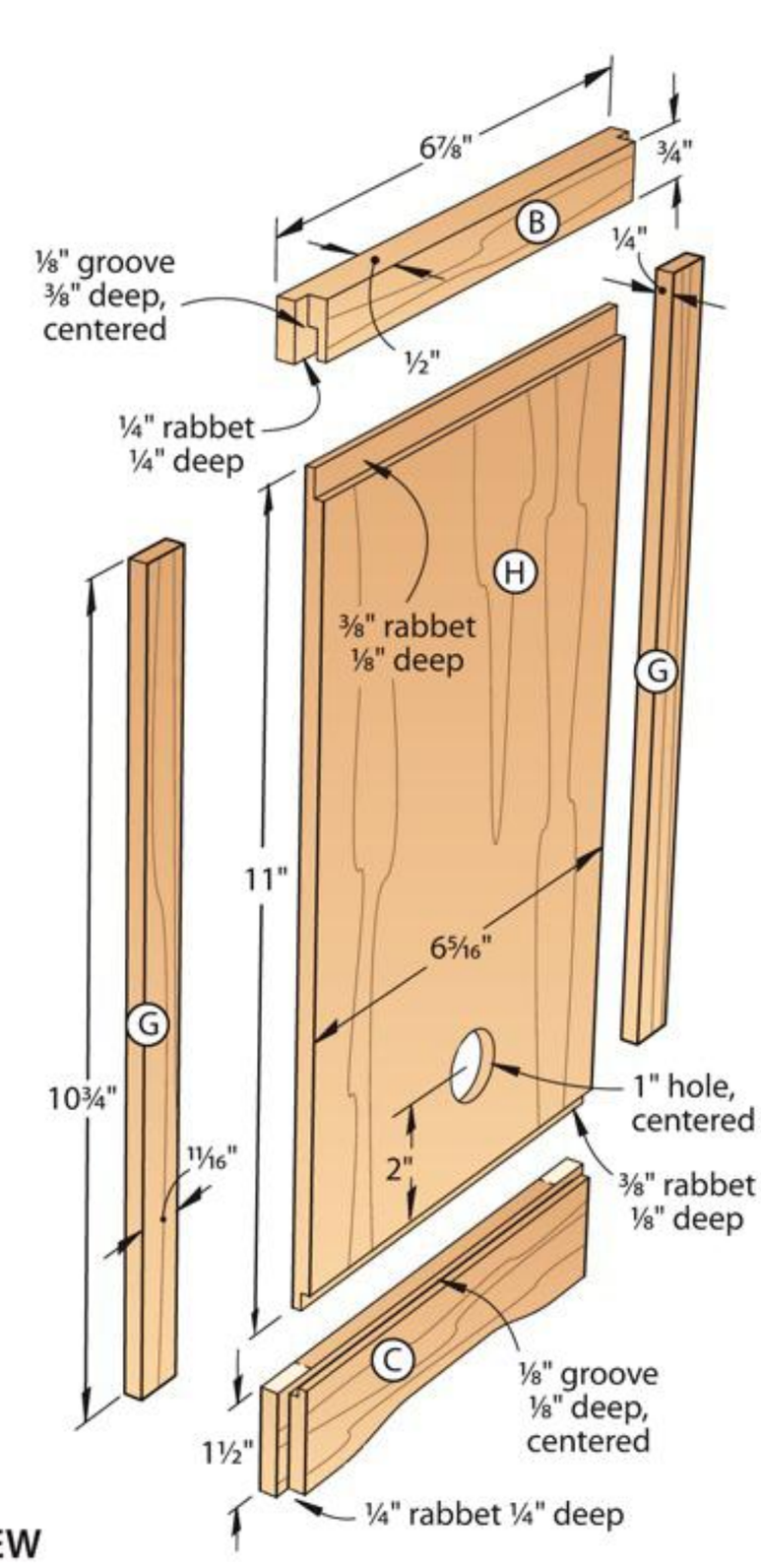
Rout a ¼" rabbet ¼" deep on each end of the rails (B, C). Back up the rail with a scrap block to steady it and prevent tear-out at the rear.

1 SIDE ASSEMBLY (right side shown)





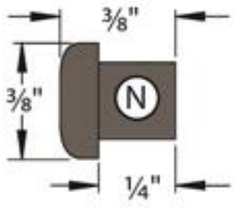
FRONT ASSEMBLY
(viewed from the back)



BACK ASSEMBLY
(viewed from the back)

2 FRAMES EXPLODED VIEW

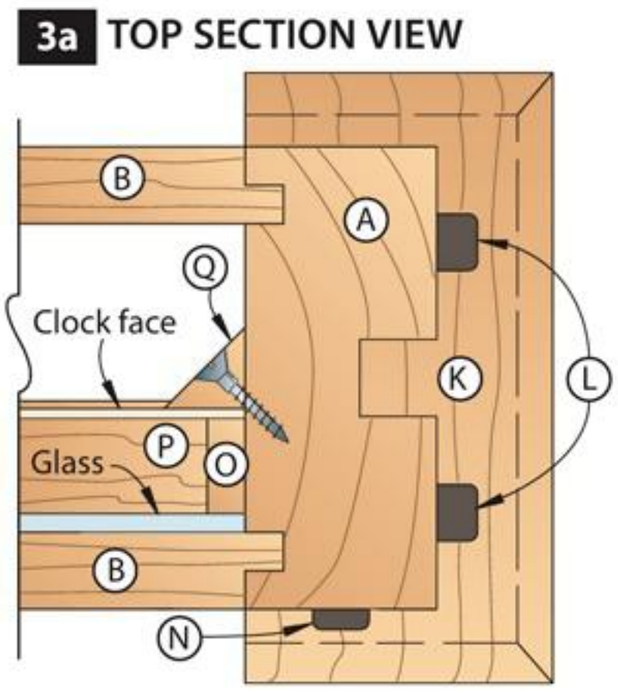
1a PLUG (side view)

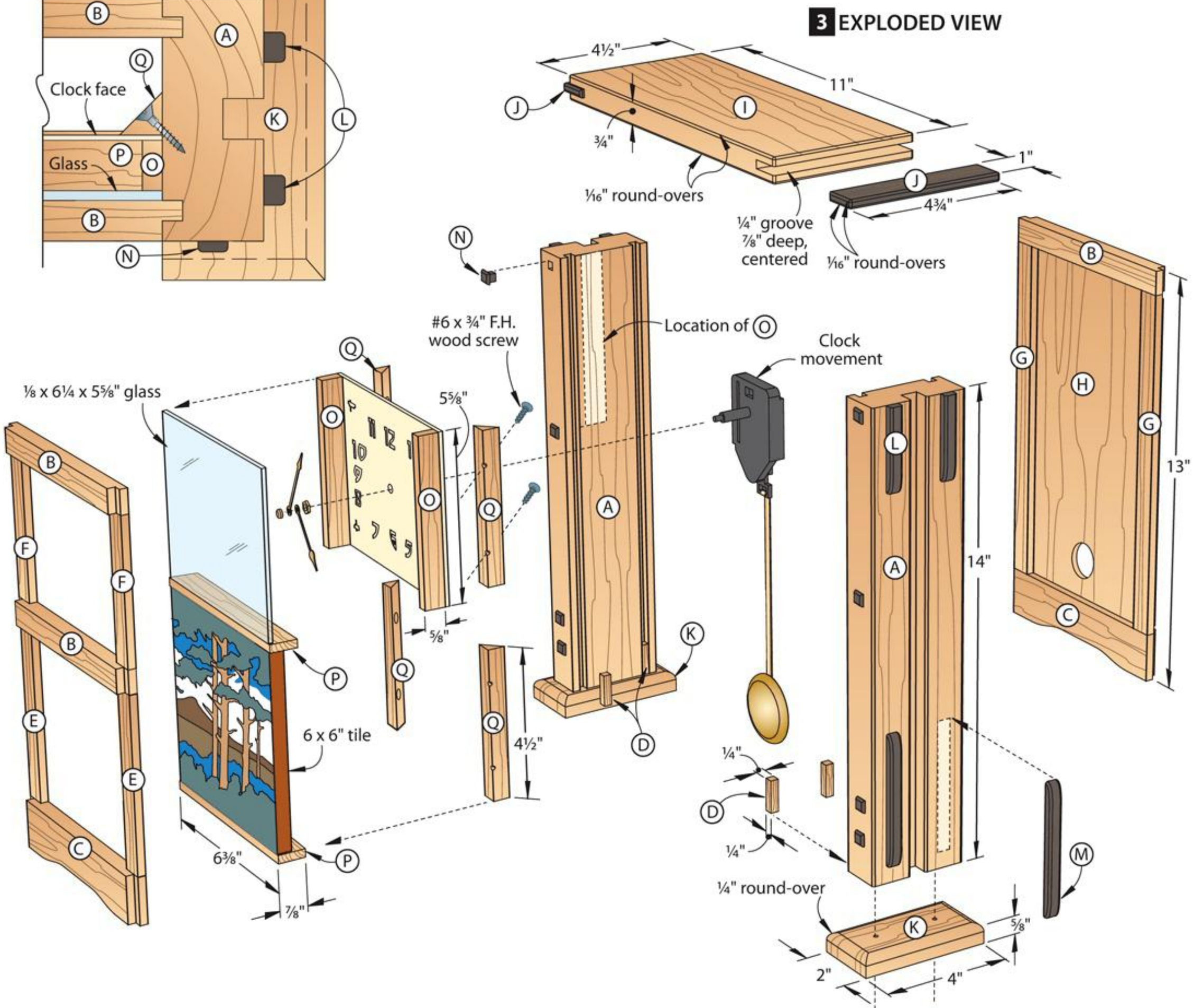


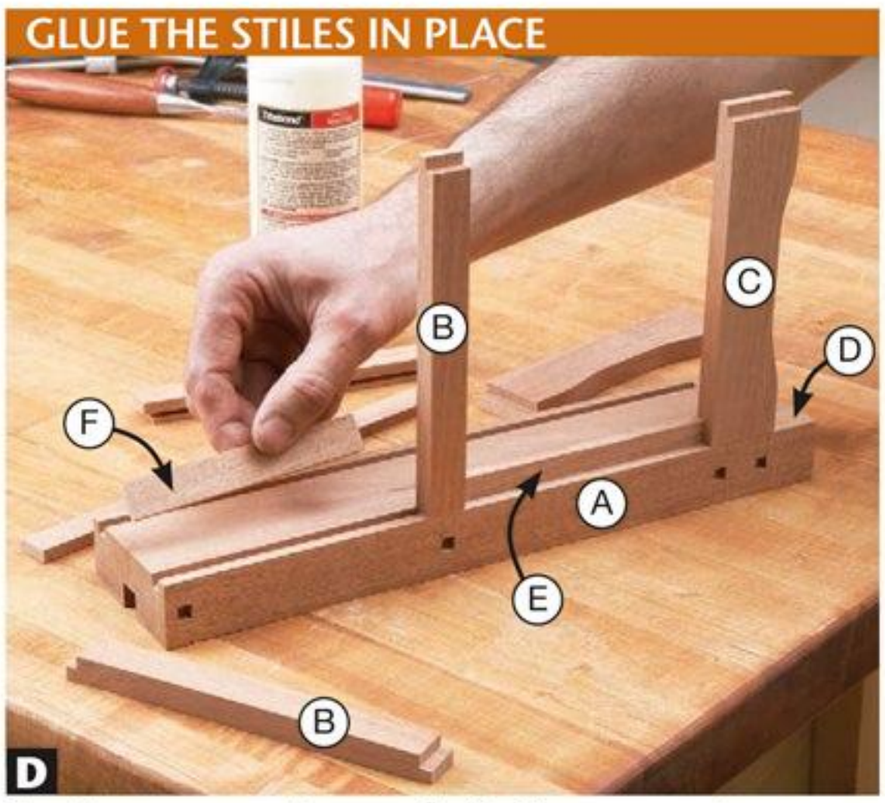
2 Drill ¼" counterbores on the front edge of each side (A) [**Drawing 1**], making sure you make mirrored sides. Square up the holes using a jig, as shown on *page 18*.

3 Cut the upper rails (B) and lower rails (C) to size [**Drawing 2**], along with an extra piece the same thickness to test router-table setups. Reposition the router-table fence and bit height to rout a ¼" rabbet ¼" deep. Rout a rabbet on the test piece to create a tongue that fits in the grooves in the sides (A). Then rout a rabbet on each end of each rail [**Photo C**].

4 Double-faced-tape the lower rails (C) together with their ends and edges flush. Make a copy of the **Lower Rail Pattern** from the *WOOD Patterns*® insert and spray-adhere it to the rails. Cut the lower rails to shape, sand them smooth, then remove the pattern with mineral spirits, and separate the rails. Install a zero-clearance insert around your tablesaw blade, and set the blade ⅛" above the table. Make cuts on your rail test piece, positioning the rip fence to center the blade on the piece's thickness. Then cut a groove along the top edge of one lower rail (C) [**Drawing 2**]. Raise the blade to ⅜" and cut a groove along the bottom







Use the upper and lower rails (B, C) as spacers to position the front lower and upper stiles (E, F). Do not glue the rails in place yet.

edge of one upper rail (B). These rails will be used for the back assembly.

5 Plane a 3¾×12" blank to fit the inside grooves in the sides (A). From this blank, rip a ¼"-wide strip for the filler strips (D) [**Drawing 3**] and four 11/16"-wide strips for the front lower and upper stiles (E, F) and back stiles (G) [**Drawing 2**]. Crosscut the filler strips and lower stiles to length. Glue a filler strip in the bottom of each groove on the inside faces of the sides flush with the bottom end.

6 Working on one side (A) at a time, dry-fit a lower rail (C) on top of a filler strip (D) and glue the front lower stile (E) in the groove [**Photo D**]. Position both upper rails (B) in the groove, with one flush with the top of the side. Measure for the final length of the front upper stile (F). Crosscut the upper stile, glue it in place, then remove the rails. Cut the back stile (G) to length [**Drawing 2**] and glue it in the other groove. Repeat this process on the other side (A).

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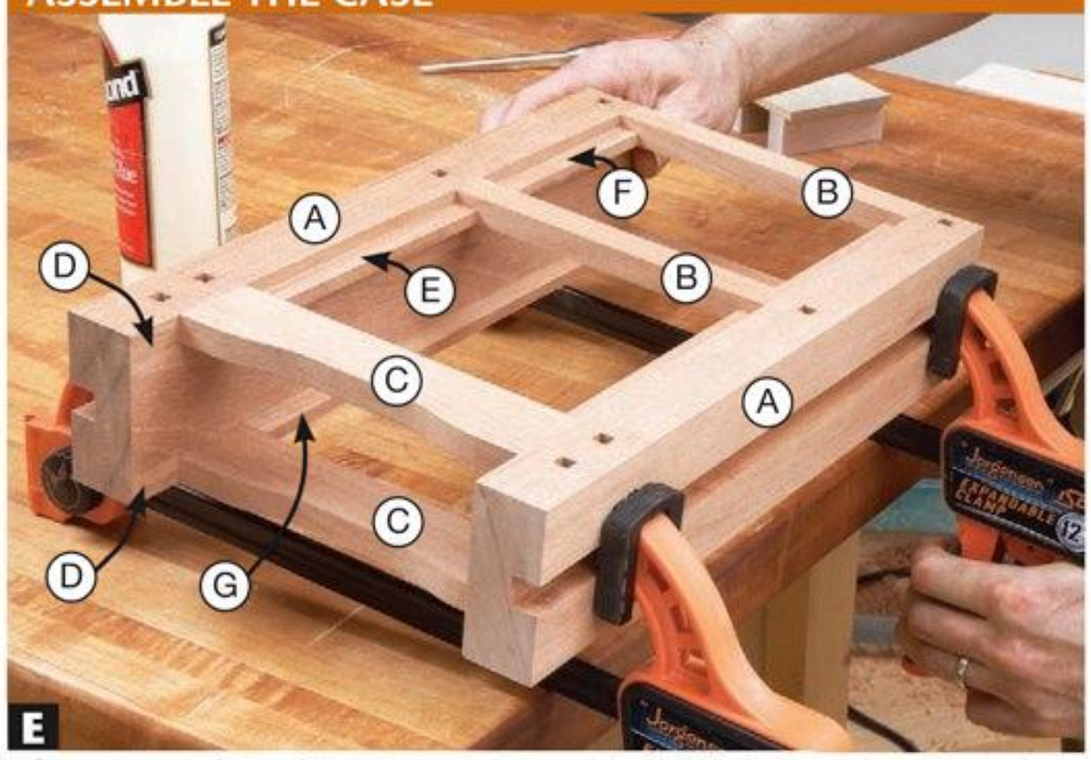
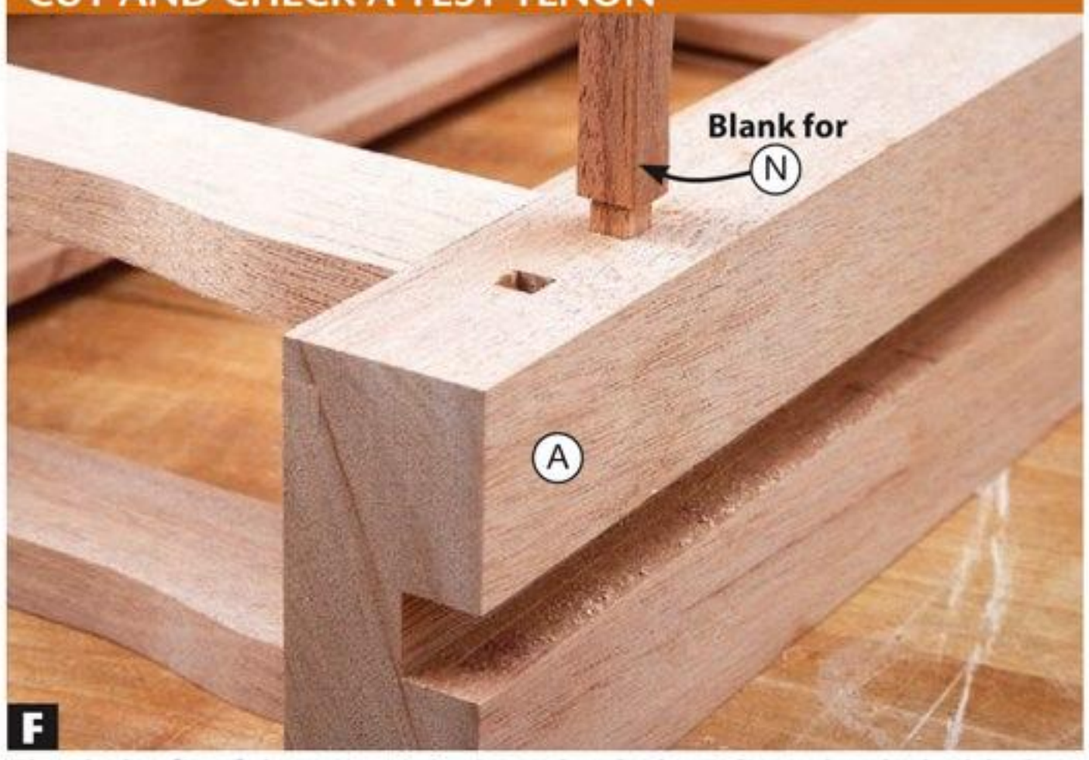


E

After gluing the stiles (E, F) in place, glue the rails (B, C) between the side assemblies (A/D/E/F). Use glue sparingly to avoid squeeze-out.



F

Check the fit of the test tenon in a plug hole. Adjust the dado-blade height as needed to perfect the fit.

7 Apply glue to the rabbet in each end of the rails (B, C) and clamp the case together [**Photo E**]. ***Note:*** *Glue the grooved rails in the rear grooves.*

8 Cut the back (H) to size [**Drawing 2**] and rout rabbets on each end. Drill the 1" hole where shown. Test the fit of the back in the case (A–G) by tilting the top tongue into the groove of the upper rail (B) and lowering the back into the groove in the lower rail (C).

Quick Tip! Tapered tongues. If needed, sand slight bevels on the tongues to improve the fit.

Add a top, feet, and accents

1 Cut the top (I) to size [**Drawing 3**]. At the tablesaw, cut a ¼" groove ⅞" deep on each end centered on the top's thickness. Sand 1/16" round-overs along the top's edges and ends. From ¼" stock, cut the splines (J) and sand 1/16" round-overs on one edge and both ends. ***Note:*** *Leave square the long edge that fits in the groove.*

2 Cut the feet (K) to size [**Drawing 3**]. At the router table, use a push pad to control these small pieces while routing ¼" round-overs around their tops.

Quick Tip! Begin with the ends. Rout the ends of the feet first. Routing the long edges last cleans up any chip-out.

3 Cut two ¼×⅜×14" blanks for the upper and lower accent strips (L, M). Cut a ⅜×⅜×14" blank for the plugs (N) and set it aside for now. Crosscut two upper and two lower accent strips from each ¼"-thick blank [**Drawing 1**]. Double-faced-tape together two matching accent strips to make four pairs. Make two copies each of the **Upper Accent Strip** and **Lower Accent Strip** patterns and spray-adhere a pattern to each pair. Sand to the pattern line on the top of the lower accents and on the bottom of the upper and lower accents. Separate the strips and sand the 1/16" round-overs along the edges of one long face of each one.

4 Set up a ¼" dado blade in your tablesaw 1/16" above the table. Retrieve the plug (N) blank and cut a ¼"-long test tenon on one end by making a pass on each face and edge. Check the fit of the tenon in a plug hole [**Photo F**]. If it fits, cut the test tenon off, then round the end of the blank on sandpaper [**Photo G, Drawing 1a**]. Cut the cheeks of the tenon [**Photo H**], then handsaw the plug (N) from the blank. Repeat this process to make eight plugs.

5 Color the splines (J), accent strips (L, M), and plugs (N) with a black permanent marker. Glue the splines in the grooves in the top (I) [**Drawing 3**]. After the glue dries, glue the top assembly (I/J) to the case (A–G), centered side to side and front to back. Glue the accent strips to each side (A), centered on each side of the groove [**Drawing 1**]. Glue the plugs in the counterbores.

Now go with the stops

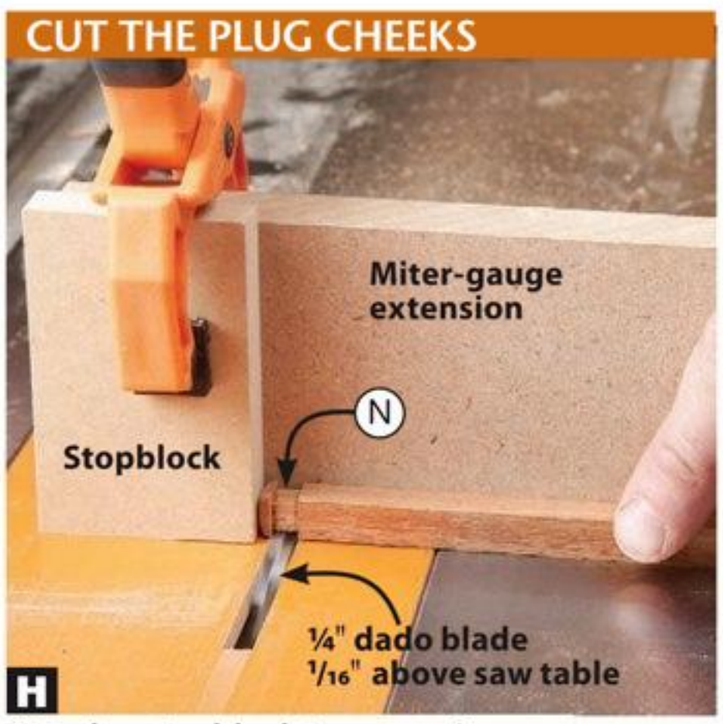
1 From ¼"-thick stock, cut the glass stops (O) and stops (P) to size [**Drawing 3**]. Cut, or have a glass shop cut, a piece of ⅛" glass to 6¼×5⅝". With the case lying facedown on your bench, put the glass in the case tight against the underside of the top (I). Glue a glass stop to each side (A), resting on the glass and snug to the top [**Drawing 3a**].

2 After the glue dries, slide out the glass. Use tape to protect the glue surfaces of the rails (B, C) and stops (P) [**Photo I**], and apply a finish. (We used Old Masters dark mahogany no. 60804 followed by three coats of spray satin lacquer, buffing lightly between coats with 320-grit sandpaper.) Remove the painter's tape after the last coat dries.

3 Rout a ½" chamfer on each edge of a ½×2½×10" blank. Rip a ½"-wide strip from each edge of the blank. Crosscut two cleats (Q) from each strip [**Drawing 3**], drill and countersink two 9/64" shank holes in each cleat, and set them aside.

G

Slightly round the end of the plug (N) blank on 120-grit sandpaper. Sand all four faces to create an even crown.



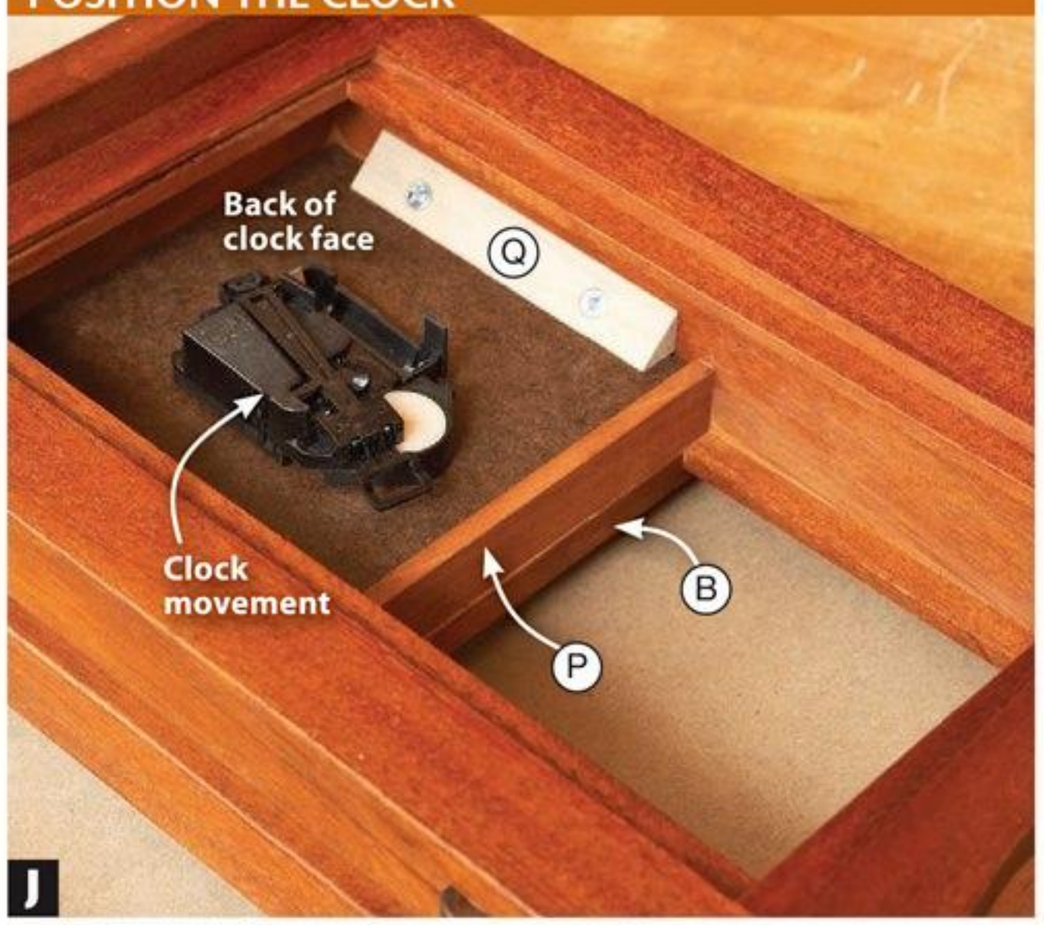
H

Attach a stopblock to your miter-gauge extension ⅛" from the blade. Cut cheeks on each face of the plug (N) blank.

PROTECT GLUE SURFACES

Before applying finish, mask off the rear faces of the center rail (B) and lower rail (C), and one edge of each stop (P).

POSITION THE CLOCK



With the clock face in place, secure it with a stop (P) and two cleats (Q). Do not glue the cleats to allow for removal of the movement.

Let's put it all together

1 Lay the case (A–G, I–O) facedown and slide the glass behind the glass stops (O). Attach the clock movement to the face and secure the hands to the stem. Rest the face on the glass stops in the case [**Drawing 3a**]. Secure a stop (P) to the back face of the rail (B) and snug against the clock face using just two drops of glue [**Photo J**]. (This allows the stop to be snapped off should you need to replace the glass.) Retrieve two cleats (Q) and screw them in place, resting against the back of the clock face.

2 Insert your tile or copper panel against the bottom face of the stop (P) and center it from side to side. Secure it with the two remaining cleats (Q). Glue the remaining stop snug to the bottom of the tile. Drill countersunk 5/32" shank holes in the feet (K). Center the feet on the bottom of the sides (A) and drill 7/64" pilot holes through the shank holes. Glue and screw the feet in place.

3 Adjust the length of the pendulum so it is visible below the lower rail (C) but swings freely. Attach it to the clock movement, install a battery, set the time, and display your work proudly.

MORE RESOURCES

FREE RELATED ARTICLE

- For another method to make and install the plugs go to woodmagazine.com/squarepunch.

MORE CLOCK PLANS

- Go to woodmagazine.com/plans and type "clock" in the search box.

About Motawi tiles

The handmade tiles in the photos on *page 40* come from the Motawi Tileworks in Ann Arbor, Michigan. Their designs take inspiration from the Arts & Crafts movement. Tiny ridges of clay form shallow pools for different colors of glaze and create a slight relief on each tile. Learn more about them and see the full selection of tiles at motawi.com.

Produced by **Craig Ruegsegger** with **Kevin Boyle**
Project design: **Schlabaugh & Sons Woodworking**
Illustrations: **Roxanne LeMoine; Lorna Johnson**

Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
A	sides	1¼"	3"	14"	M	2
B	upper rails	½"	¾"	6⅞"	M	3
C	lower rails	½"	1½"	6⅞"	M	2
D*	filler strips	¼"	¼"	1"	M	4
E*	front lower stiles	¼"	1 1/16"	5½"	M	2
F*	front upper stiles	¼"	1 1/16"	4½"	M	2
G*	back stiles	¼"	1 1/16"	10¾"	M	2
H	back	¼"	6 5/16"	11"	M	1
I	top	¾"	4½"	11"	M	1
J	splines	¼"	1"	4¾"	M	2
K	feet	⅝"	2"	4"	M	2
L*	upper accents	¼"	⅜"	2½"	M	4
M*	lower accents	¼"	⅜"	4"	M	4
N*	plugs	⅜"	⅜"	⅜"	M	8
O	glass stops	¼"	⅝"	5⅝"	M	2
P	stops	¼"	⅞"	6⅜"	M	2
Q*	cleats	½"	½"	4½"	M	4

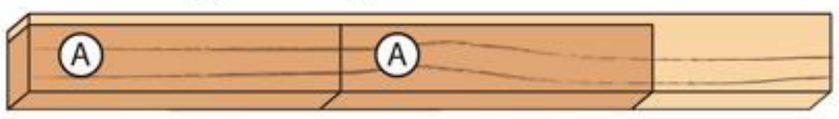
*Parts initially cut oversize. See the instructions.

Material key: M-mahogany.
Supplies: Spray adhesive, #6×¾" flathead wood screws (8), #8×1¼" flathead wood screws (4), ⅛×6¼×5⅝" glass.
Blade and bits: Dado blade; 45° chamfer, ¼" straight, ½" straight, ¼" round-over router bits; 7/64", 5/32", 1" drill bits.

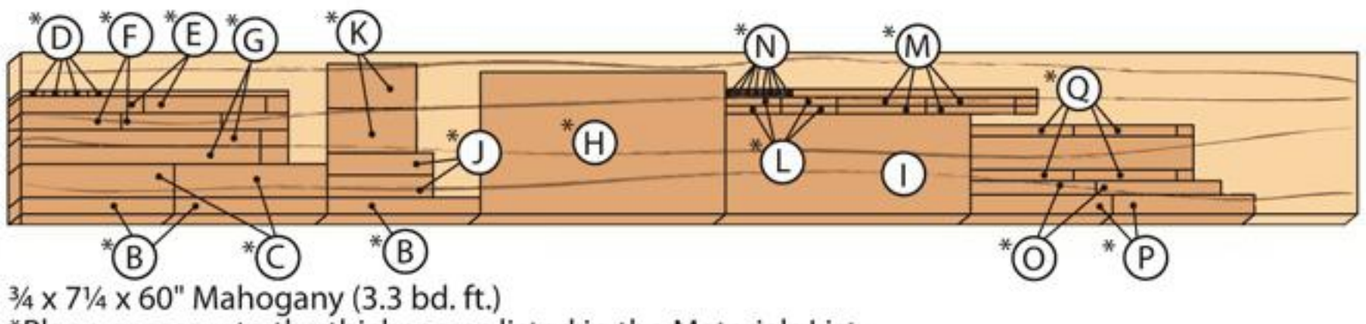
Source

Hardware kits: Pendulum clock movement, hands, face (no tile or panel) no. 200GG-D, $20.90. Clock kit and your choice of 6×6" tile or panel: pine-landscape tile no. 200GG-A, $88.90; Gamble House tile no. 200GG-B, $76.90; copper panel no. 200GG-C, $32.90; Schlabaugh & Sons Woodworking, 319-656-2374, schsons.com.

Cutting Diagram



1¼ x 3½ x 36" Mahogany (1.5 bd. ft.)



¾ x 7¼ x 60" Mahogany (3.3 bd. ft.)
*Plane or resaw to the thicknesses listed in the Materials List.

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Better Homes and Gardens®
WOOD® PATTERNS®
November 2010 Issue 201

Dear Reader: As a service to you, we've included full-size patterns on this insert for irregular-shaped and intricate project parts. You can machine all other project parts using the Materials List and the drawings accompanying the project you're building.

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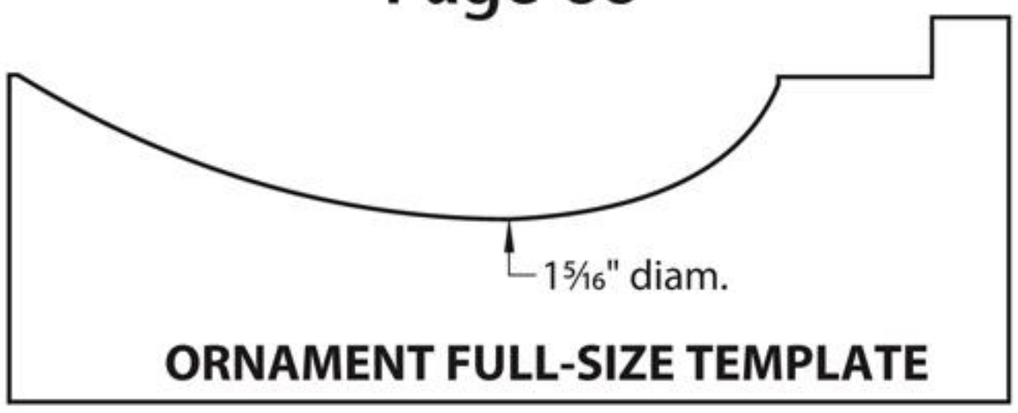
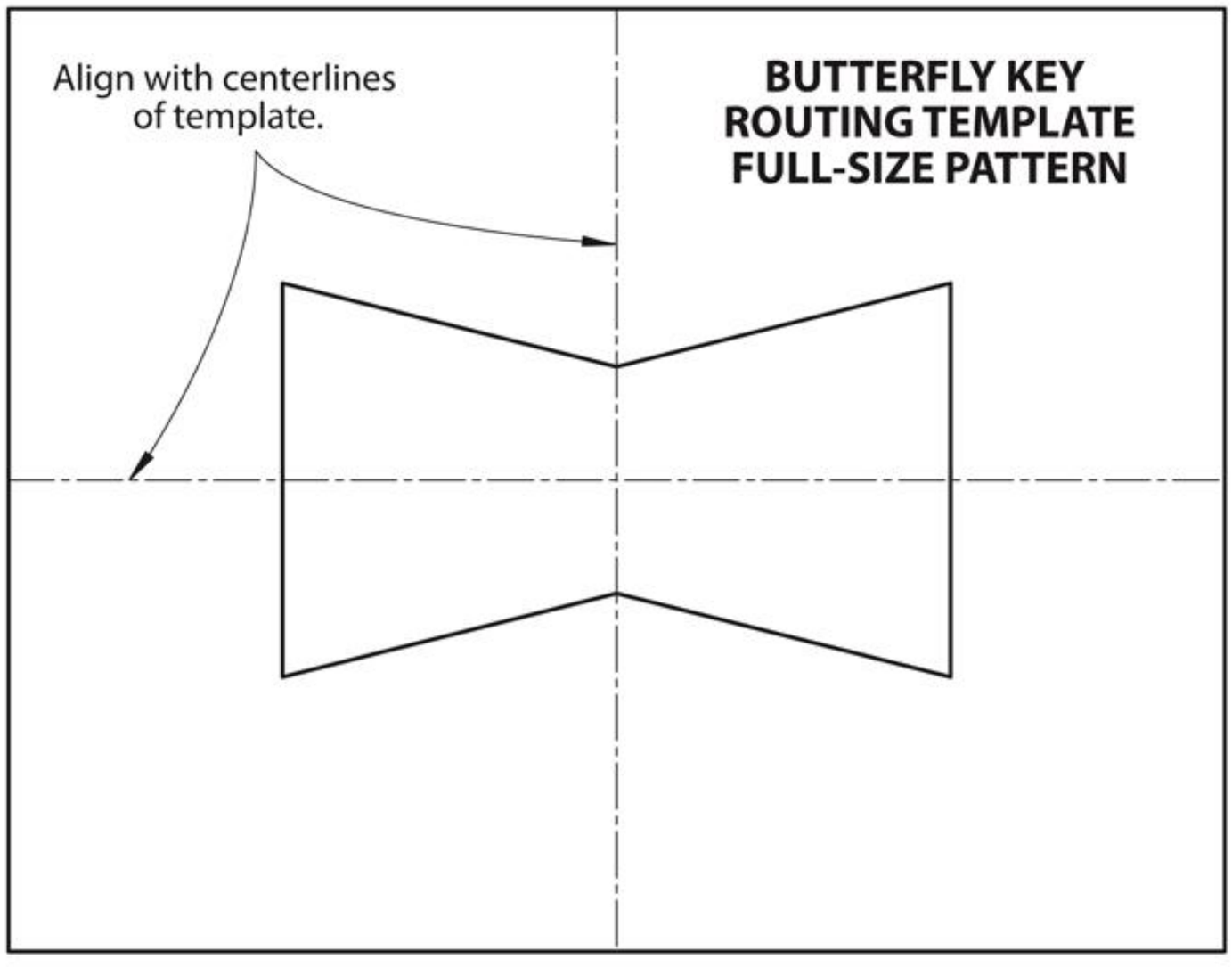
Turned Christmas Ornament
Page 66

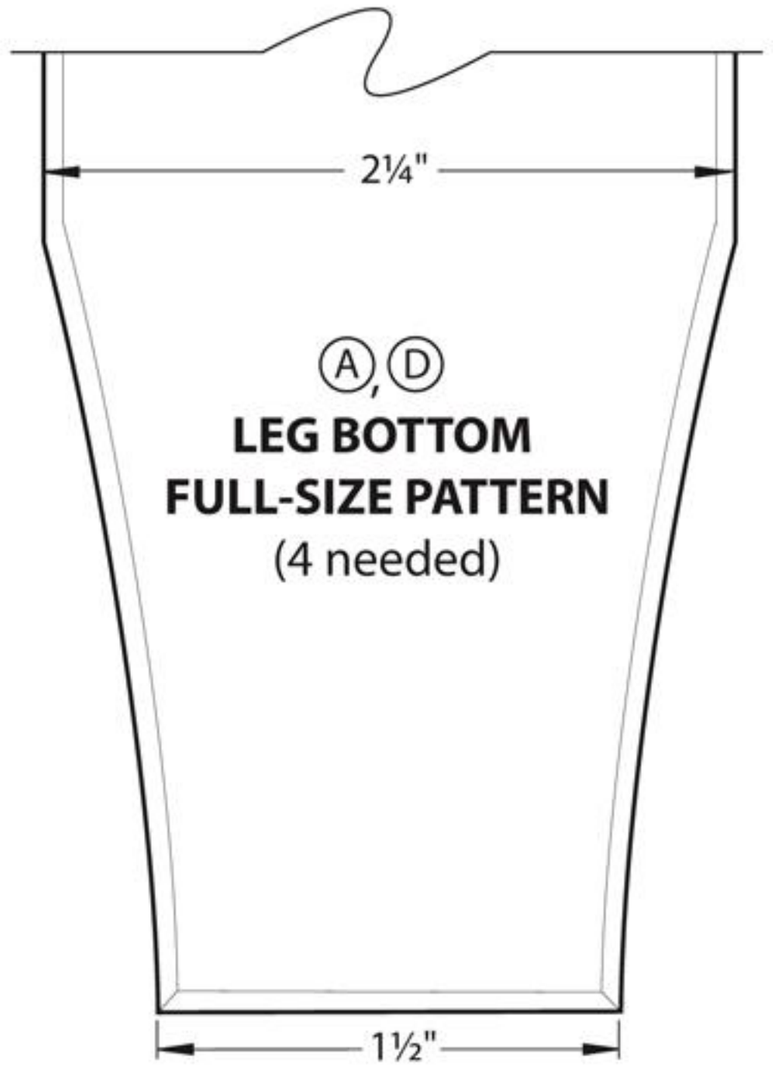


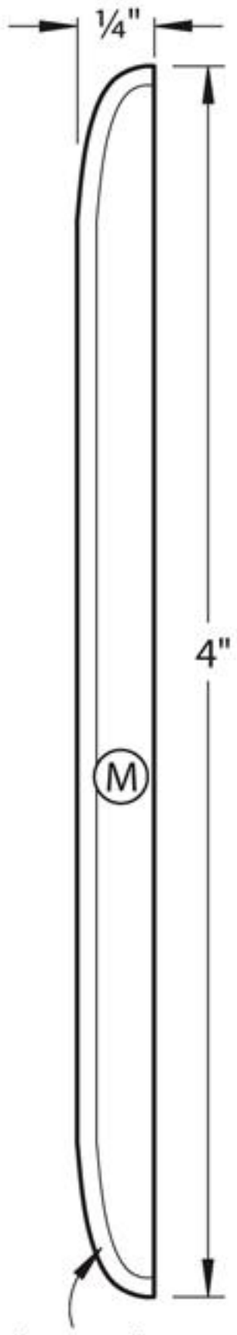
ORNAMENT FULL-SIZE TEMPLATE

Heirloom Tool Chest
Page 50

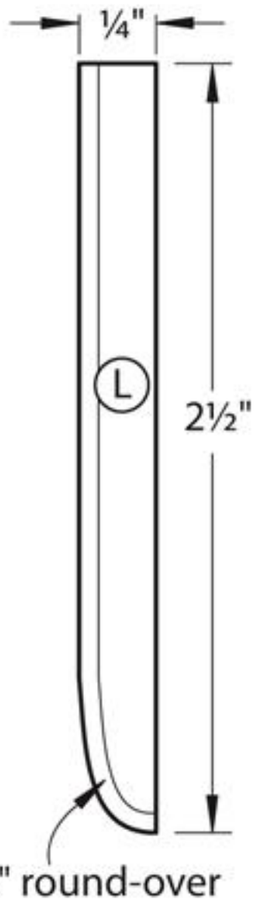


Built-with-a-tilt Book Nook
Page 34

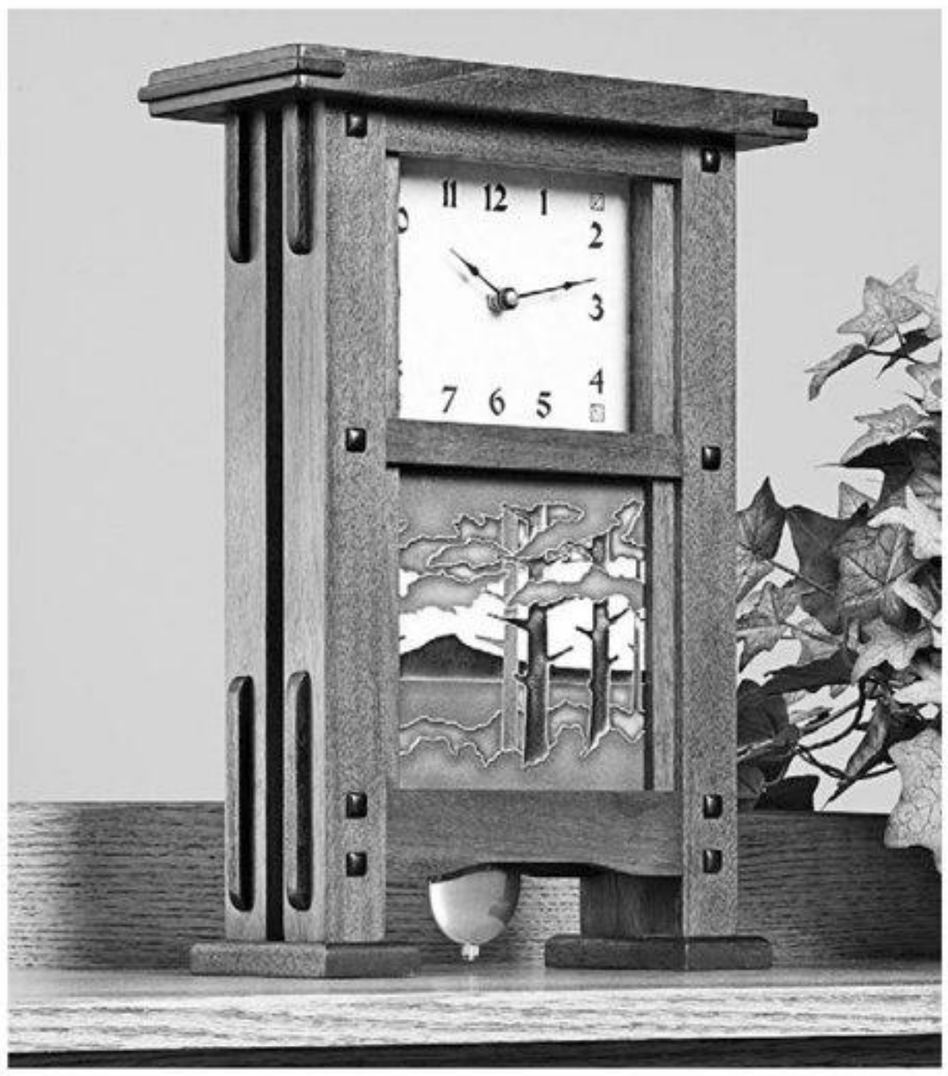




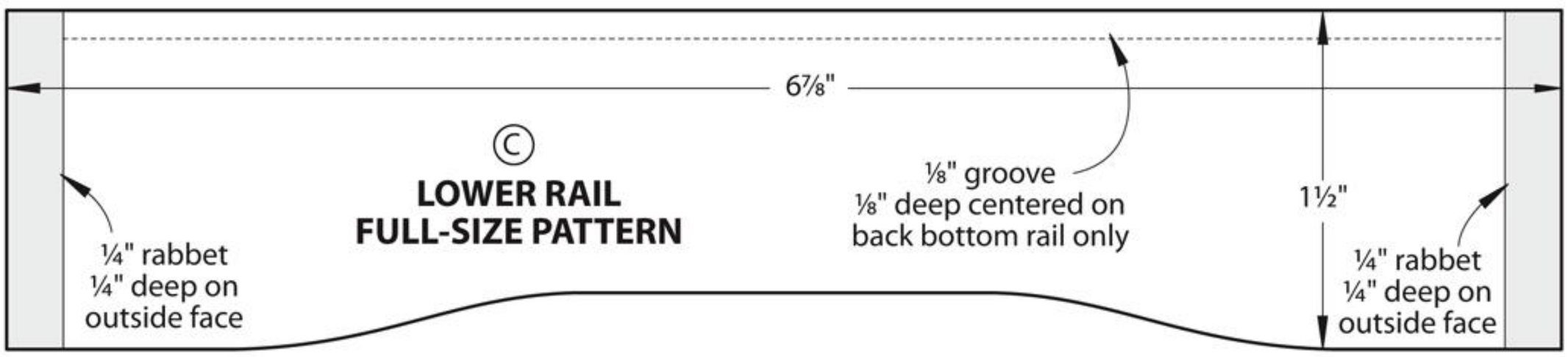
LOWER ACCENT STRIP
FULL-SIZE PATTERN



UPPER ACCENT STRIP
FULL-SIZE PATTERN



Greene & Greene-style Clock
Page 40



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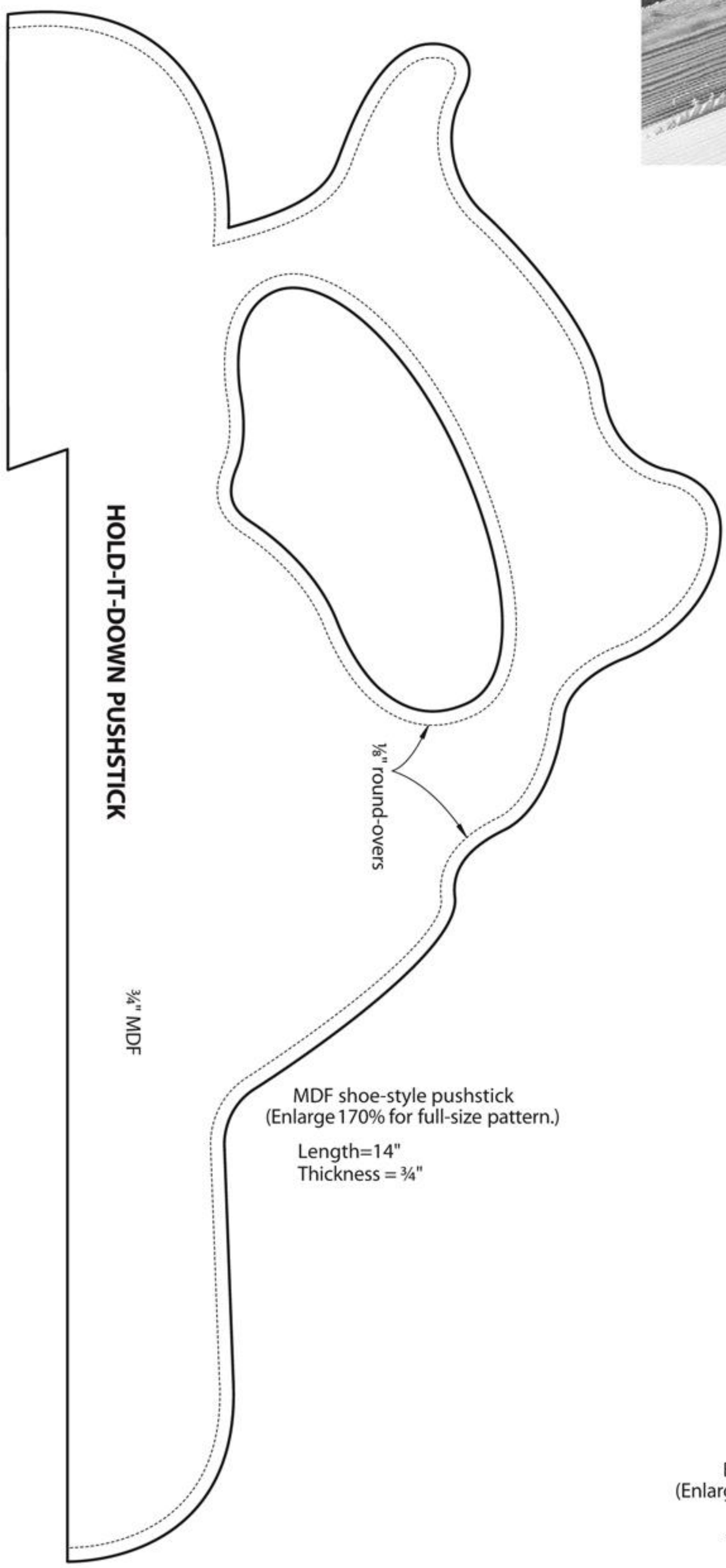
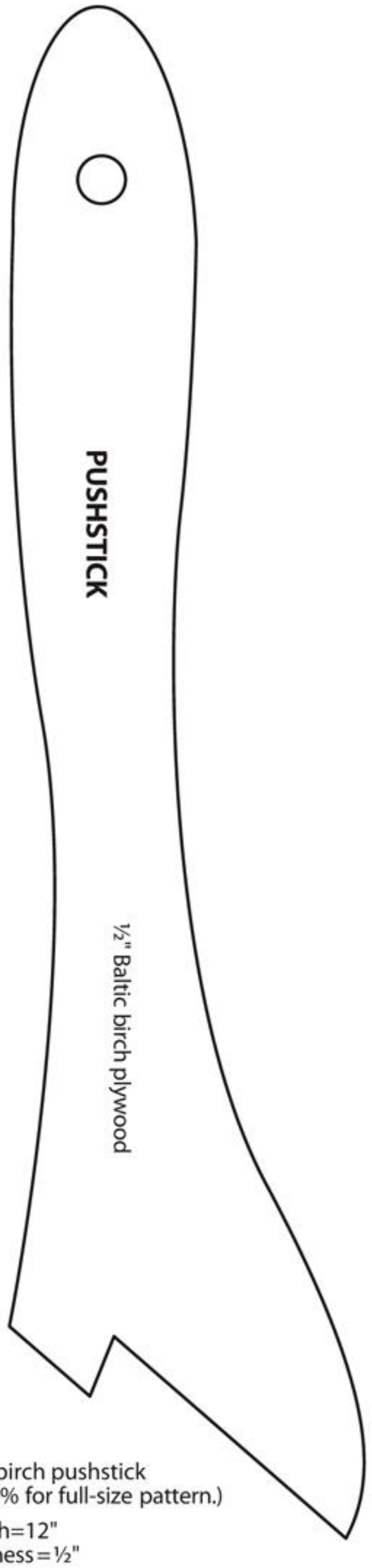
BONUS PATTERNS:
Two Do-it-Yourself Pushsticks



MDF shoe-style pushstick
(Enlarge 170% for full-size pattern.)

Length=14"
Thickness = ¾"



Baltic birch pushstick
(Enlarge 170% for full-size pattern.)

Length=12"
Thickness = ½"

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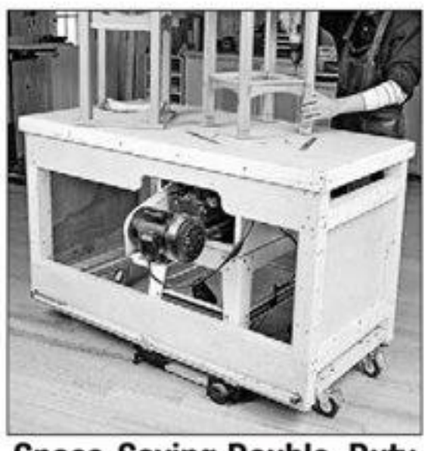

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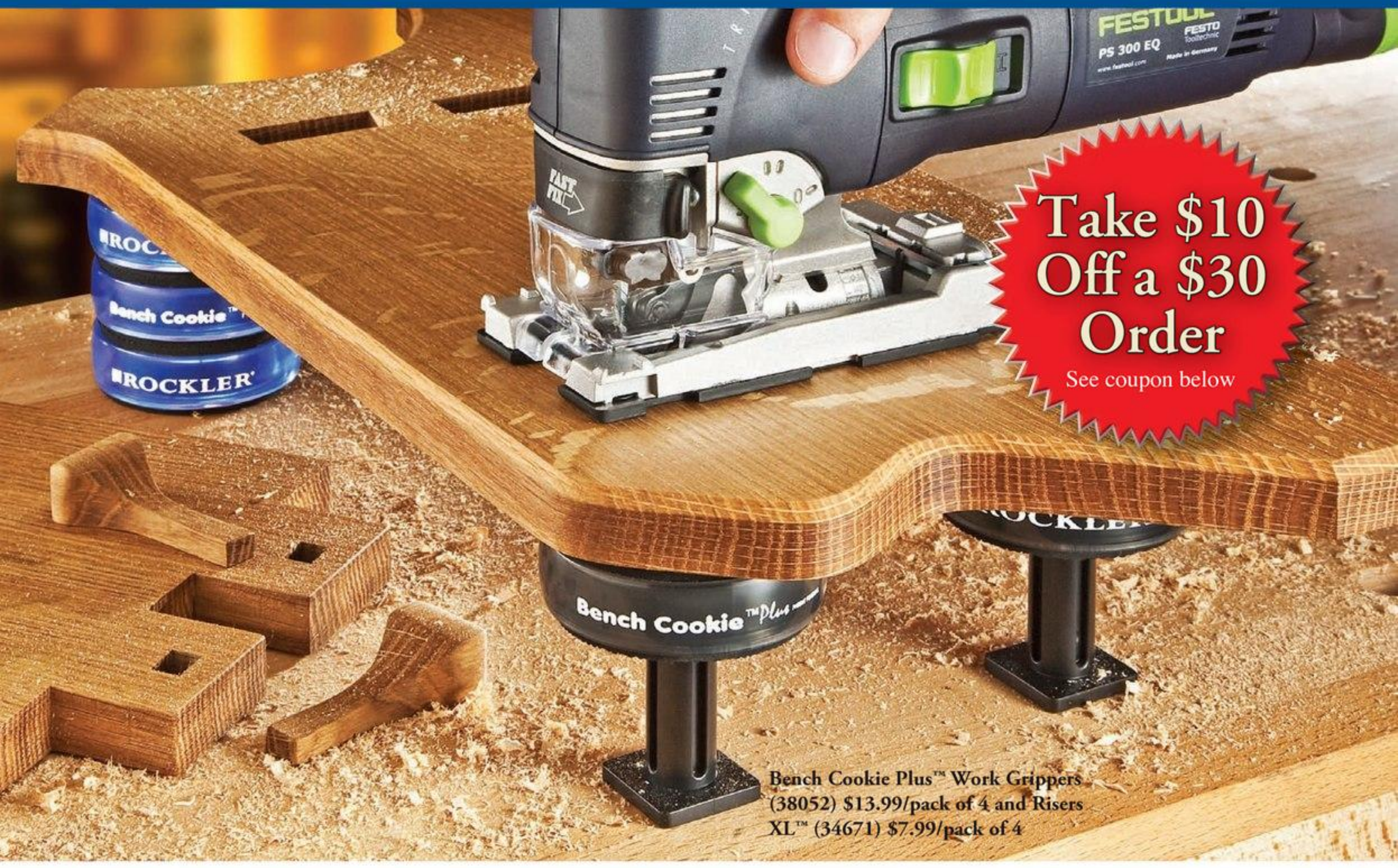

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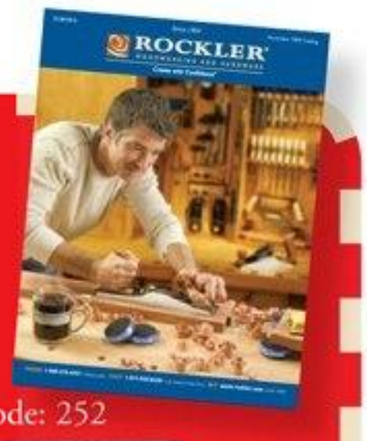
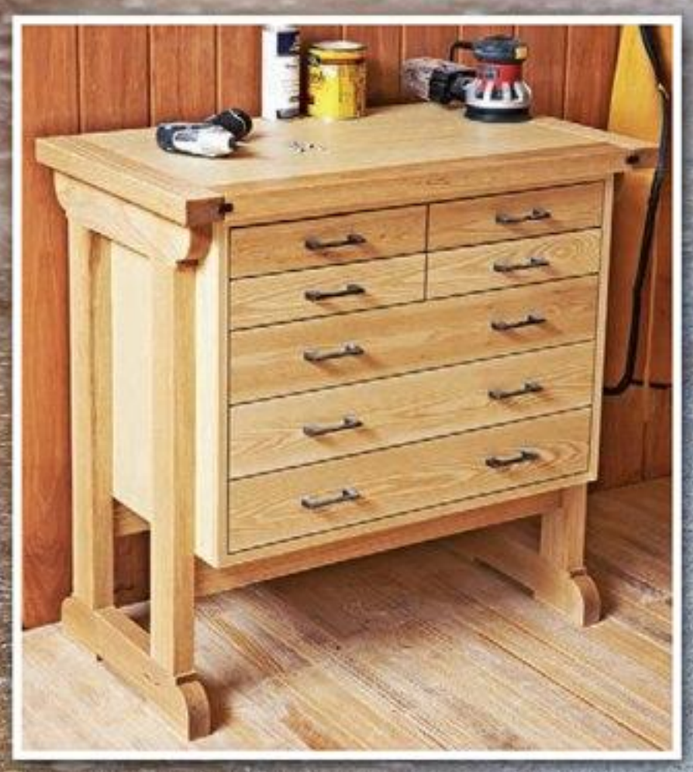


Materials Code: 252

460110 10032 6

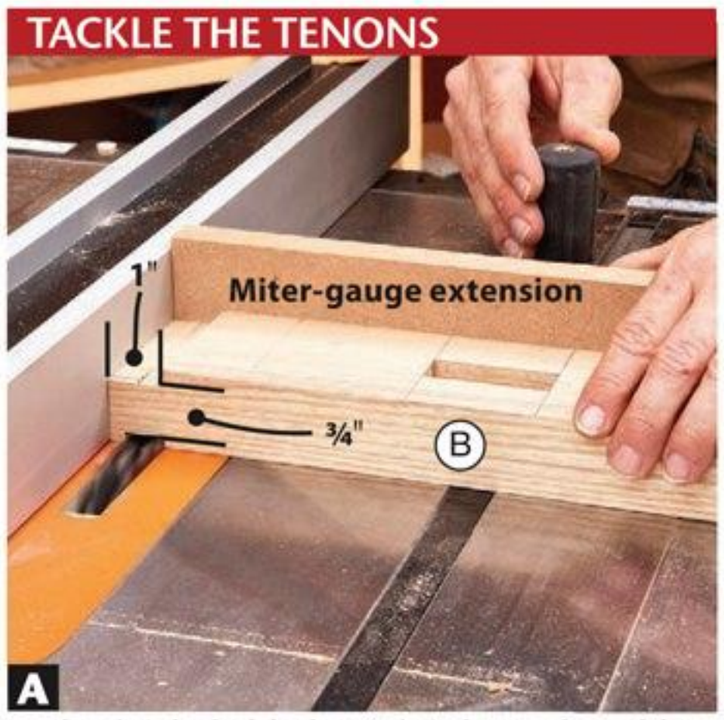
Heirloom Tool Chest

A storage showpiece for your shop



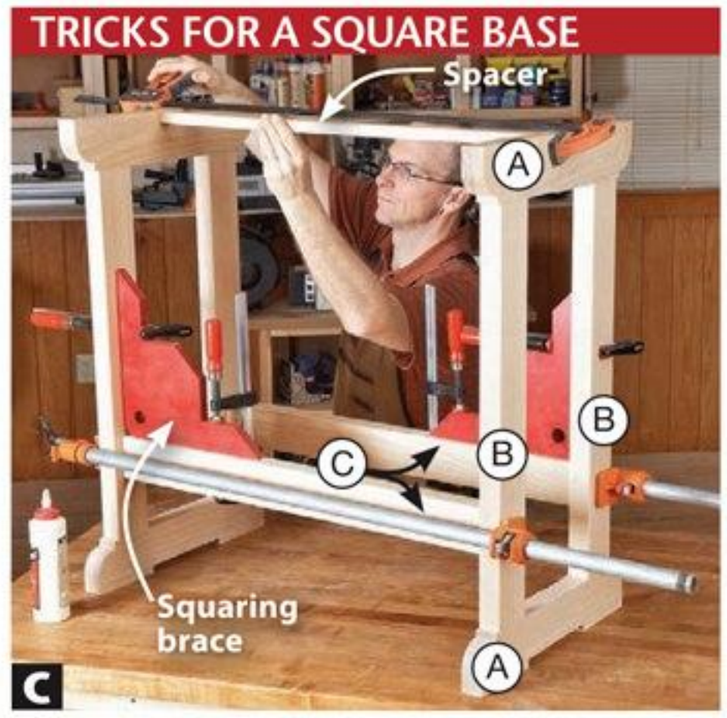
Build just the base and drawers for a small workbench with big storage.

Dimensions: 36½"W×20³⁄₁₆"D×76"H



With a ¾" dado blade set ⅜" above the table, cut a test tenon on scrap. Then cut tenons on the uprights (B) and stretchers (C).

To prevent the foot (A) from chattering along the rip fence, a spacer clamped to the fence creates space, allowing the foot to slide freely.



Squaring braces keep the uprights (B) and stretchers (C) square. A spacer prevents the top of the assemblies from tilting in or out.

Pamper your hand tools and shop supplies in this elegant, yet easy-to-build, home. This cabinet is merely a collection of plywood and hardwood boxes supported by a sturdy base. The base offers plenty of drawer space and by itself makes a compact workbench [**inset photo,** *opposite page*]. Shadow lines and decorative butterfly keys add detail to the doors. A router bushing kit (*page 28*) help you easily fit the keys.

Start with a sturdy base

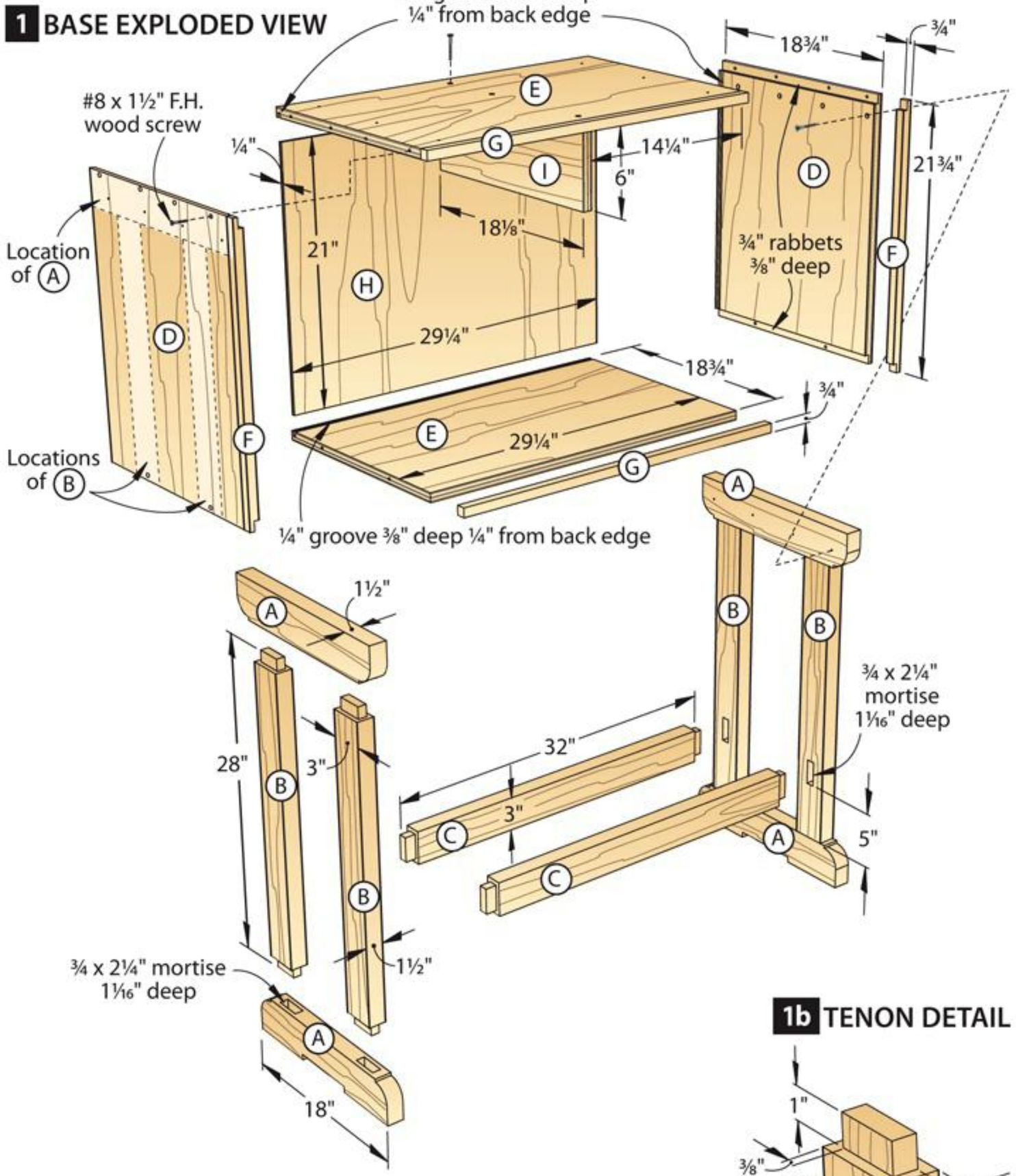
1 From 1½"-thick stock, cut the feet and rails (A), uprights (B), and stretchers (C) to size [**Materials List,** *page 57*]. Lay out the curved shoulders on the tops of the feet and bottoms of the rails [**Drawing 1a**]. Set your tablesaw blade ¼" above the table and the rip fence 1⅜" from the blade. Make crosscuts on the feet and rails to establish the square shoulders.

2 Lay out the mortise locations on the feet and rails (A) and uprights (B) [**Drawings 1, 1a**]. At the drill press, drill out most of the waste using a ¾" Forstner bit. Use the Quick and Easy Jig on *page 18* to help square up the mortises.

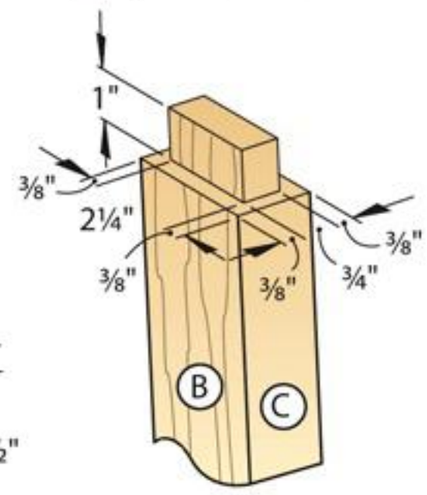
3 Cut 1"-long tenons on the uprights (B) and stretchers (C) to fit the mortises [**Drawing 1b**; **Photo A**]. Raise the blade to ½" above the table and readjust the rip fence to cut the 6"-wide notch on the bottom of the feet (A) [**Drawing 1a; Photo B**]. Bandsaw the round shoulders of the rails and feet (A) close to the layout lines. Finish shaping them using 150-grit sandpaper on a sanding block.

4 Sand all parts to 220 grit. Then glue up the base, making sure it is square [**Photo C**]. ***Quick Tip! Fill open space with a spacer.*** Cut a spacer the same length as a stretcher (C) less the tenons to help with assembly.

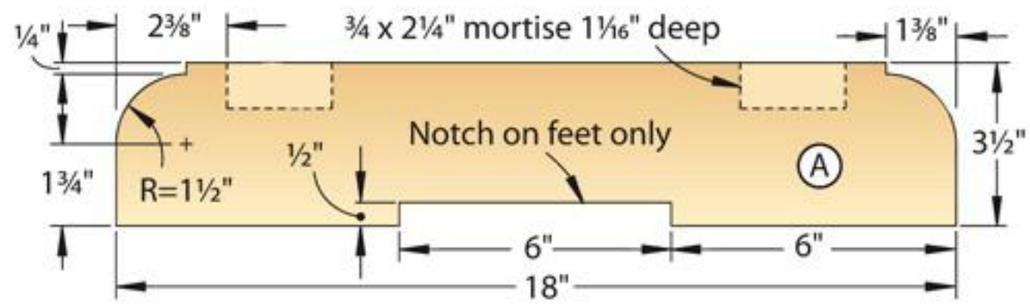
1 BASE EXPLODED VIEW



1b TENON DETAIL



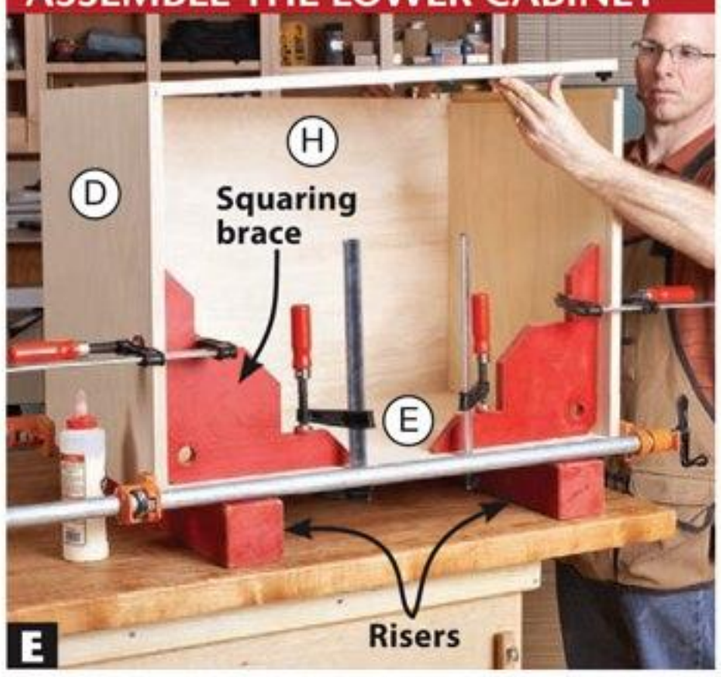
1a FOOT/RAIL DETAIL



MARK, DON'T MEASURE

Rest the edged side panels (D/F) against the stretchers (C) and mark their final length at the tops of the rails (A).

ASSEMBLE THE LOWER CABINET



Set the bottom (E/G) on risers to create room for the squaring braces' clamps. Clamp the case until the screws are driven.

POSITION HARDWARE PERFECTLY

Work from the highest to lowest slides. When reaching the lowest slides, remember to add the mates to each side of the divider (I).

Create a cabinet

1 Cut the side panels (D) and the top/bottom panels (E) ¼" longer than listed [**Materials List, Drawing 1**]. Rip ¾"-wide side edging (F) and top/bottom edging (G), plane it to match the thickness of the side and top/bottom panels, and glue the edging in place.

Quick Tip! Keep joints in line. Clamp along the joint line of the edging and panel to keep the faces flush.

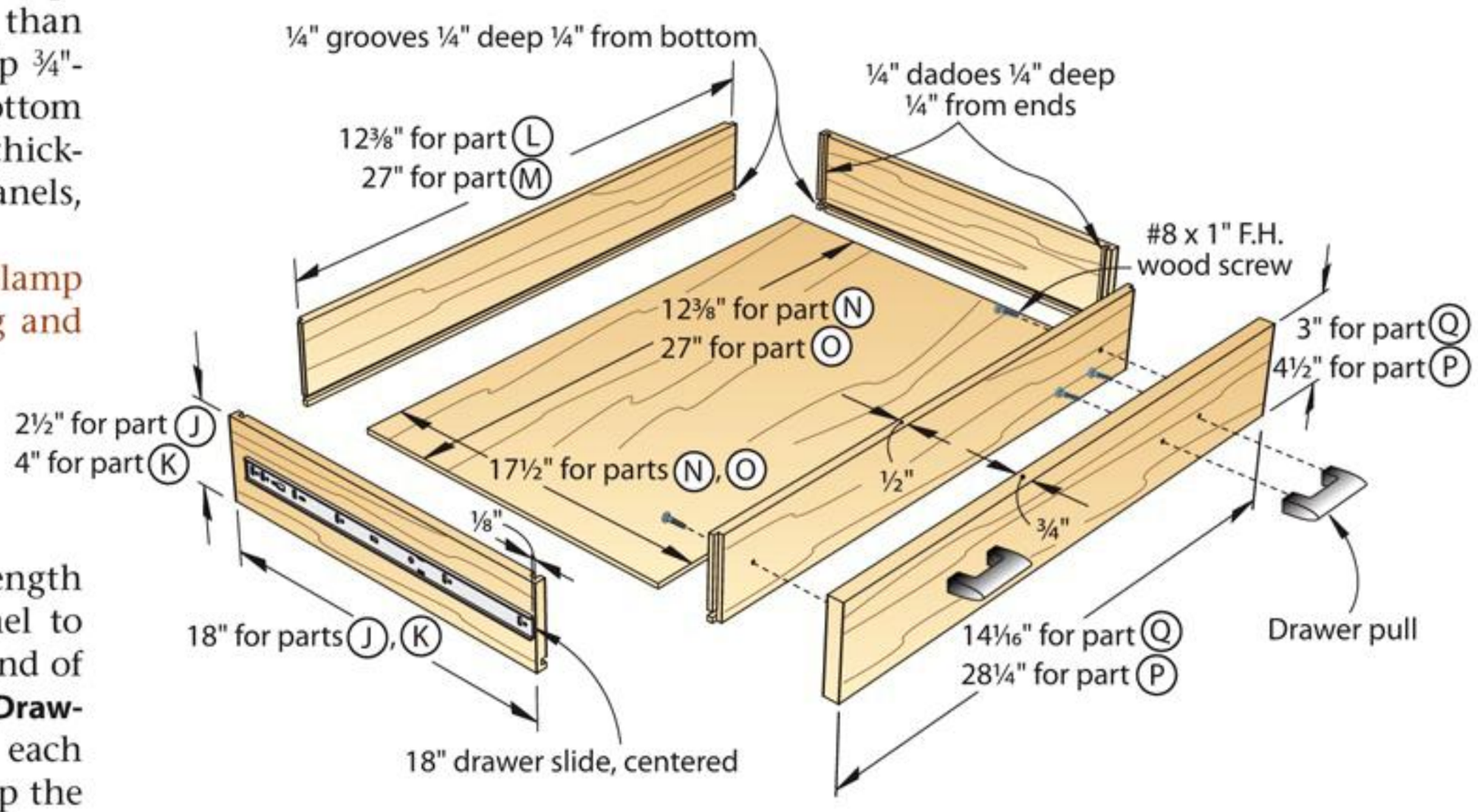
2 At the tablesaw, trim ⅛" from one end of each panel (D/F, E/G), then place each of the side panels against the stretchers (C) to mark their final length [**Photo D**]. Crosscut each side panel to length at this mark. Rabbet each end of the panels to fit the top/bottom [**Drawing 1**]. Cut a ⅜"-deep groove in each piece to accept the back (H). Clamp the side panels inside the base (A–C), measure for the length of the top/bottom panels, and crosscut them 1/32" less than this measurement. (This allows the case to slide in easily during final assembly.)

3 Cut the back (H) to size and sand the cabinet panels to 220 grit. Glue and clamp the case together [**Photo E**]. Drill countersunk 7/64" pilot holes and screw the side panels (D) to the top/bottom panels (E) [**Drawing 1**]. Cut the divider (I) to size. Glue and screw it in place, centered on the top panel and ⅞" from the front face of the edging (G).

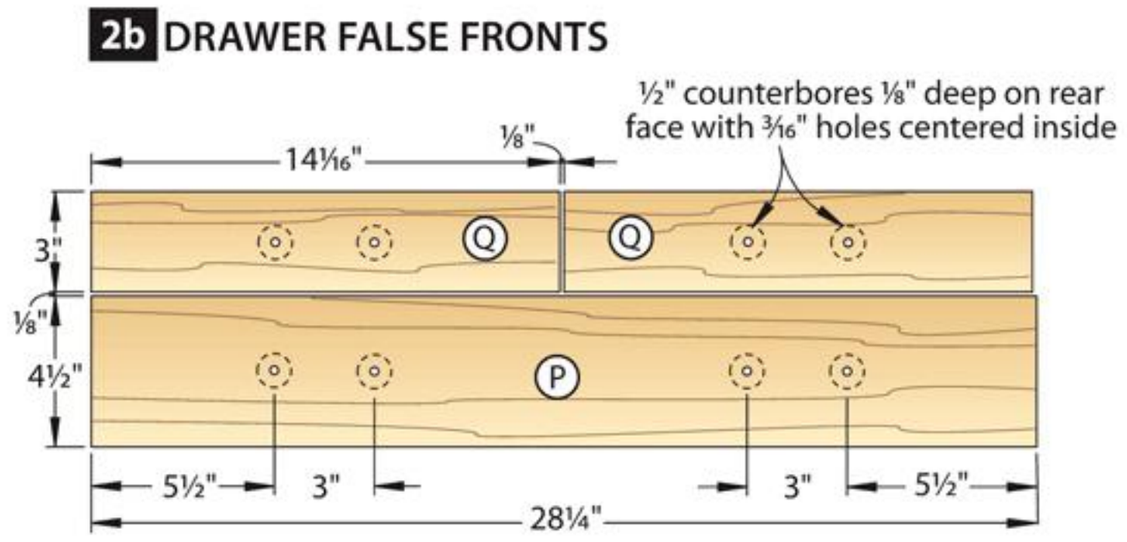
Store more in drawers

1 Plane stock to ½" thick for the drawer sides (J, K) and fronts/backs (L, M) [**Drawing 2**]. Rip the sides, fronts, and backs to width. Crosscut the sides 1" less than the inside depth of the cabinet. Crosscut the fronts/backs 1½" shorter than the width of the openings into which they'll fit.

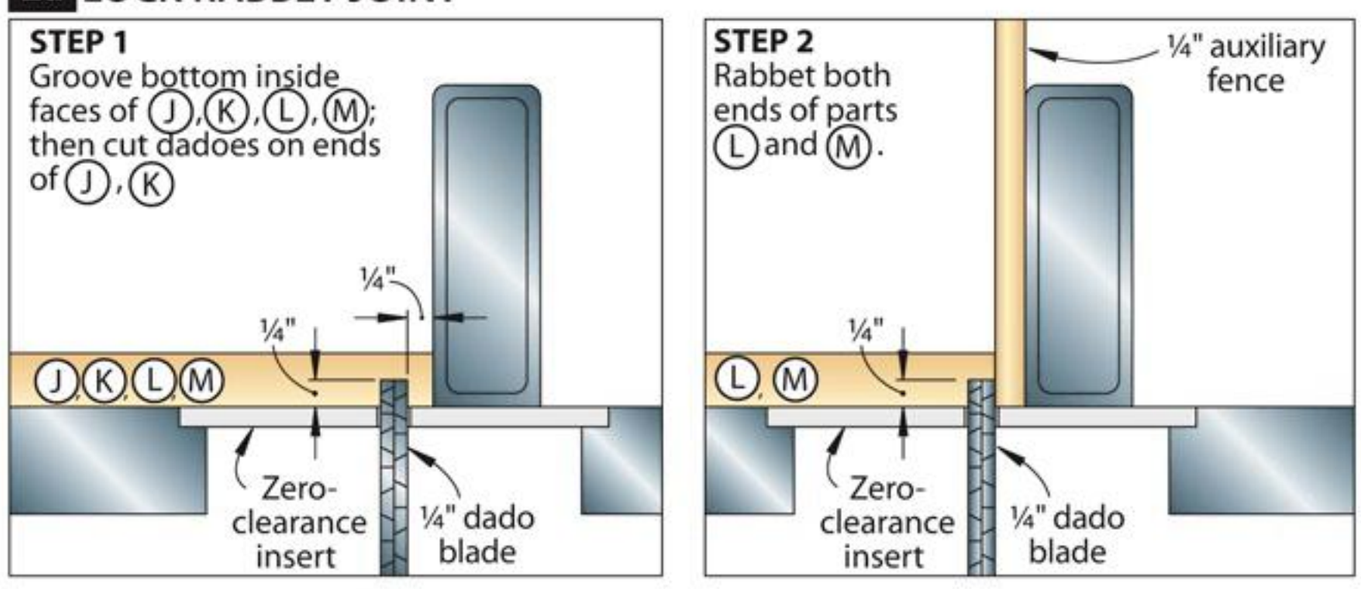
2 DRAWER


¼" grooves ¼" deep ¼" from bottom
¼" dadoes ¼" deep ¼" from ends
12⅜" for part L
27" for part M
#8 x 1" F.H. wood screw
12⅜" for part N
27" for part O
3" for part Q
4½" for part P
2½" for part J
4" for part K
17½" for parts N, O
½"
⅛"
¾"
18" for parts J, K
14⅛" for part Q
28¼" for part P
Drawer pull
18" drawer slide, centered

2b DRAWER FALSE FRONTS



2a LOCK RABBET JOINT



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2 Cut a groove to match the thickness of the drawer bottoms (N, O) toward the inside bottom of each drawer piece (J–M) [**Drawing 2**]. Cut a ¼" dado across the inside ends of each drawer side (J, K) [**Step 1, Drawing 2a**]. Add an auxiliary fence to the rip fence, and cut a ¼" rabbet along the ends of each drawer front/back (L, M), leaving a tongue that fits the dadoes in the drawer sides [**Step 2, Drawing 2a**]. (See **More Resources** on *page 57* to find a free video of this technique.)

3 Dry-fit the drawer parts (J–M) and measure for the drawer bottoms (N, O). Cut the bottoms to size from ¼" plywood, sand all the inside surfaces of the drawer parts to 220 grit, and assemble the drawers.

4 After the glue dries, sand the drawers' outside faces to 220 grit. To ready the drawers for the slides, draw a centerline down the length of each drawer side (J, K). Draw slide centerlines on one side of the lower cabinet (D–I) where dimensioned [**Drawing 3**], then flip the cabinet upside down on your bench. Separate the two portions of each drawer slide. Screw the narrow inner portions to the drawers, centered on the layout line and set ⅛" back from the front of the drawer [**Drawing 2**].

5 Cut a plywood spacer to size so that when you rest a slide on the top edge of the spacer, the uppermost layout lines in the upside-down case are centered in the slide's screw holes. Secure the slide with two screws, then screw another slide to the opposite side of the cabinet. Cut the spacer to support the next slide down. Repeat this process to mount the remaining slides [**Photo F**]. Flip the cabinet right side up and slide the drawers into position. If the drawers fit well, drive the remaining screws into the drawer slides.

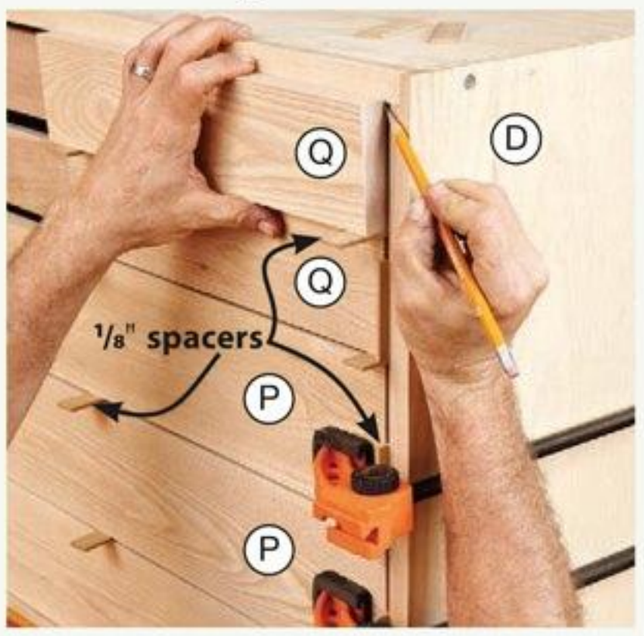
6 Rip the drawer false fronts (P, Q) 1/32" overwidth [**Drawing 2**]. Crosscut the large-drawer false fronts (P) ¼" less than the cabinet's interior width. Crosscut the small-drawer false fronts (Q) 3/16" less than half of the interior's width. Install them as shown in the **Shop Tip**, *below*.

7 Lay out, drill, and counterbore holes on the back face of the false fronts (P,

SHOP TIP

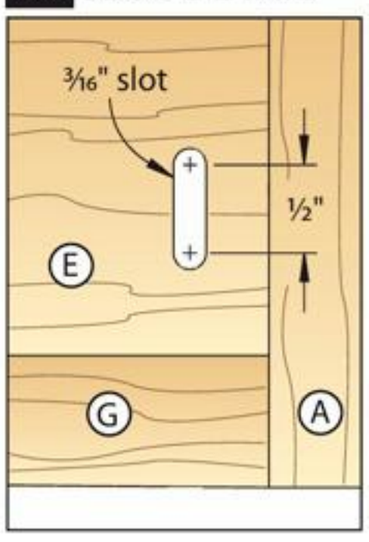
Easy drawer-front spacing

To create even gaps between the false fronts (P, Q), you'll need to trim the slightly oversize blanks. To determine how much, clamp the false fronts against the drawers, with ⅛" spacers below each one. Mark the top false front as shown *below* and measure to create a ⅛" gap at the top. Rip half this amount from each small false front. ***Note:*** *If more than ¼" needs to be trimmed, take equal amounts from the small false fronts and one or more large false fronts.*



3 EXPLODED VIEW

3a SLOT DETAIL



USE THE PULL HOLES TEMPORARILY

Drive #8×1" screws through the drawer-pull holes to temporarily hold the false fronts (P, Q) to the drawer boxes.

Q) for the drawer pulls [**Drawing 2b**]. Remove all but the lowest drawer from the cabinet. Place ⅛" spacers below and on both ends of the lowest false front (P), and temporarily screw the front to the drawer [**Photo G**]. Install the next drawer and repeat this procedure to attach all the false fronts. Drive #8×1" flathead wood screws from inside the drawer [**Drawing 2**], then remove the temporary screws. Now remove the false fronts, labeling the back face of each one and its matching drawer so you can remount them after finishing.

8 Remove the drawers from the cabinet (D–I) and slide the cabinet into the base (A–C). Drill countersunk pilot holes and screw the cabinet to the rails (A) [**Drawing 1**].

9 If you aren't building the upper cabinet, refer to **Steps 3–7** in the next section, **Build up the upper cabinet,** to build a workbench top. And see **Steps 4–5** under **Install the doors and finish it up** on *page 56* for how to mount the top and apply a finish.

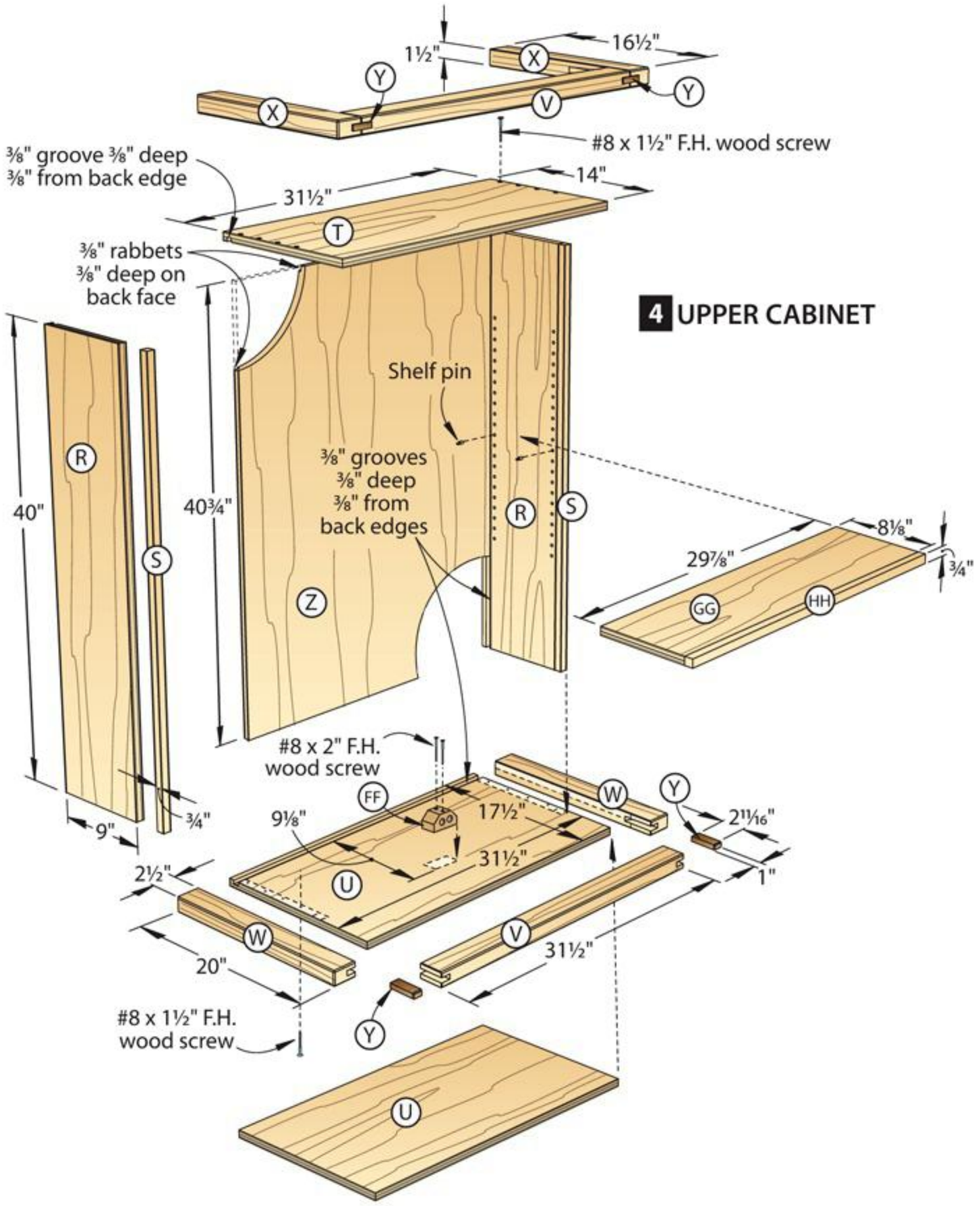
Build up the upper cabinet

1 Cut the sides (R) and side edging (S) to size [**Drawing 4**]. Glue the edging to the front edges of the panels. Cut the top (T) and two bottoms (U) to size. Set one bottom aside for now.

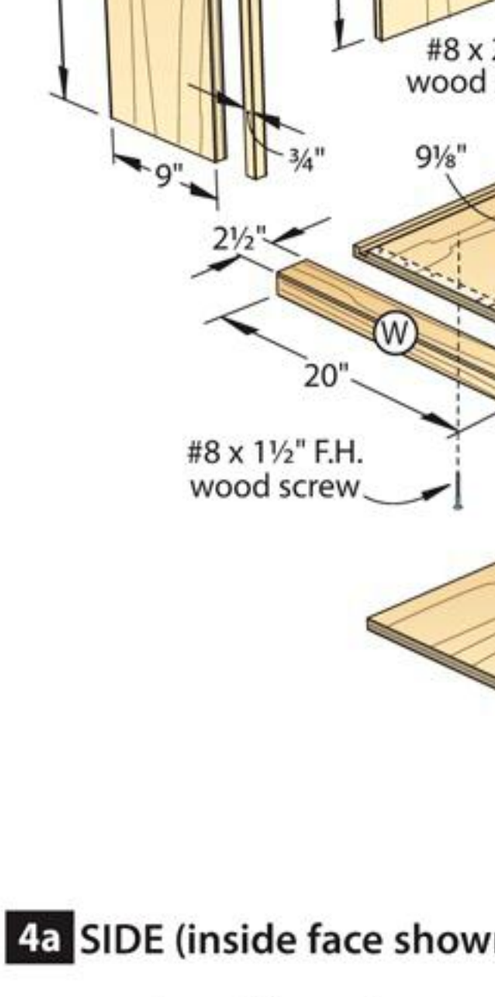
2 Cut a ⅜" groove ⅜" deep ⅜" from the rear edge of the sides (R/S), top (T), and one bottom (U) [**Drawing 4**]. Drill the shelf-pin holes in the sides where shown [**Drawing 4a**]. (For a free video to help with this, see **More Resources**.)

3 For the front trim (V), lower side trim (W), and upper side trim (X), plane stock to match the combined thickness of both bottom panels (U). Rip the trim to width. Crosscut the front trim to match the length of the top (T)

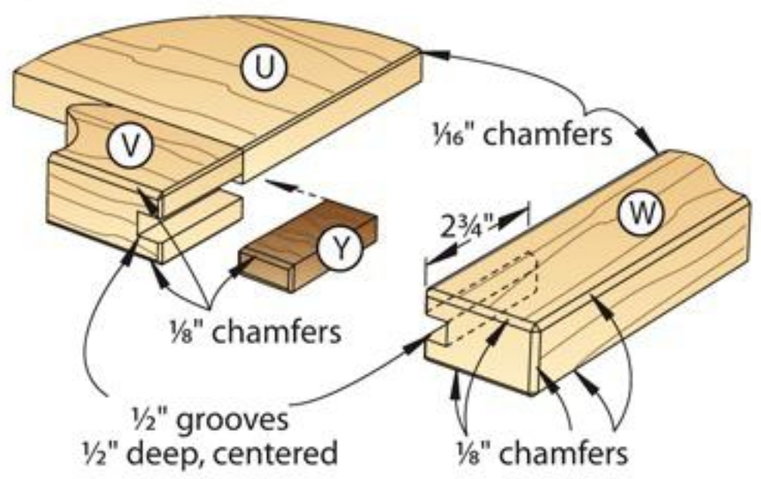
4 UPPER CABINET



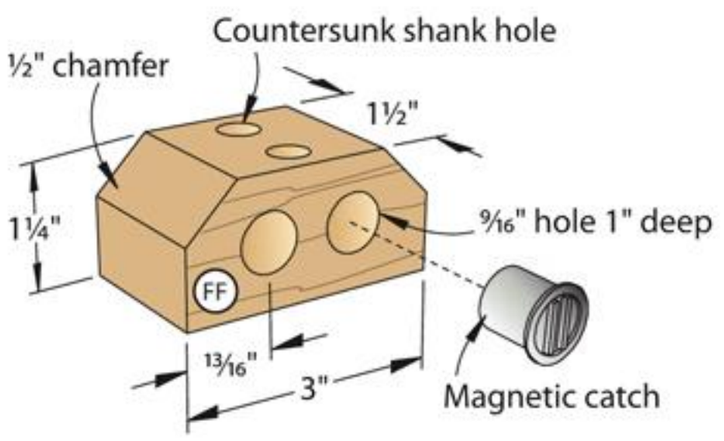
4a SIDE (inside face shown)



4b SPLINE DETAIL



4c DOOR STOP



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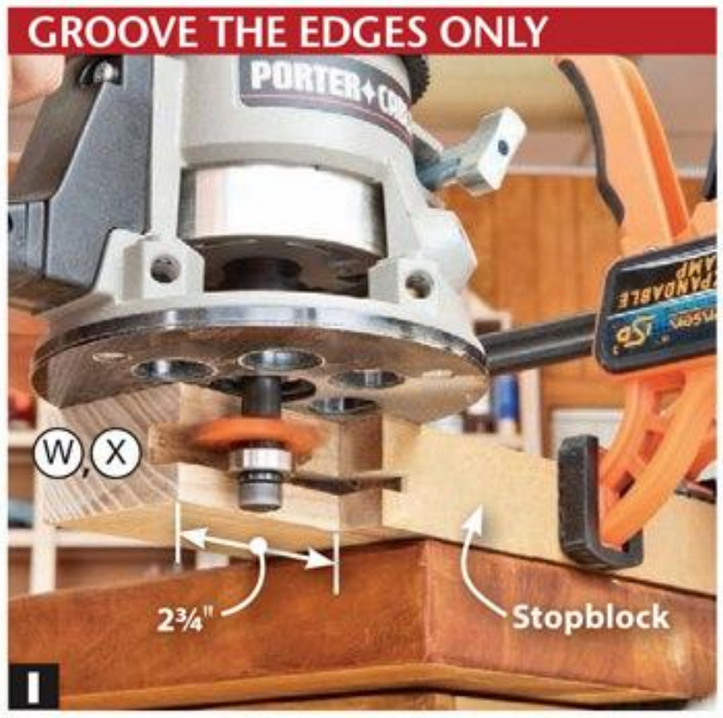
Rout a groove ½" from one face, flip the trim (V) over and rout from the opposite face to create a centered groove.



When routing the side trim (W, X), rout only the edge, not around the end. The curved end of the groove is covered after assembly.

Glue and clamp splines (Y) into the slots of the front trim (V), then glue and clamp the side trims (W or X) to this assembly.

and bottom (U). Crosscut the side trim pieces 1" longer than listed.

4 In your handheld router, mount a ¼" slotting cutter set for a ½"-deep cut, and set the bit with a ½" gap between the cutter and the router base. Clamp 1½"-thick scraps to either side of a front trim piece (V) and rout a centered groove across each end [**Photo H**]. To rout the matching grooves in the side trim (W, X), clamp a stopblock 2¾" from the front end of the trim. Rout only along the edge until the bit bearing bumps into the stopblock. Flip the piece over and widen the groove [**Photo I**].

5 Glue the front trim (V) to the top (T) and bottom (U), flush with their inside faces and ends. After the glue dries, finish-sand the panels and front trim to 220 grit.

6 Crosscut the unslotted end of each side trim (W, X) so the trim's length matches the widths of the top (T/V) or bottom (U/V). Rout 1/16" and ⅛" chamfers on the top (T/V), bottom (U/V), and side trim where shown [**Drawing 4b**]. Finish-sand the side trim to 220 grit.

7 For the splines (Y), plane a 2 11/16 × 7" walnut blank to fit in the grooves in the trim (V, W, X). Crosscut 1"-long splines from the blank and sand ⅛" chamfers on one edge of each one [**Drawing 4b**]. Glue a spline in a slot on the front trim (V) tight to the bottom (U). The spline will extend 3/16" past the front edge of the trim [**Photo J**]. Glue the side trim (W) in place, then repeat this procedure on the opposite side and for the top (T) and side trim (X). ***Note:*** *Don't overdo the glue. It's difficult to clean squeeze-out from the chamfers where the panels and trim meet.*

8 Cut the back (Z) from ¾" plywood. Rabbet the edges to leave a tongue that fits the grooves in the sides (R), top (T), and bottom (U). Sand the back and sides to 220 grit.

9 Lay the back (Z) inside-face up on your bench. Spread glue in the groove and along the mating surfaces of a side (R/S) and glue it to the back. Glue and screw the top assembly (T/V/X/Y) in place [**Photo K**]. Glue the remaining side in place and screw the top to this side. Glue and screw the bottom assembly (U/V/W/Y) to the sides. Glue and clamp the remaining bottom (U) in place and allow the assembly to dry [**Drawing 4**].

A spacer as wide as the side trim (X) provides a solid registration surface for aligning the sides (R/S) while driving the screws.

Do the doors

1 Cut the door sides (AA) to size, ¼" shorter than the interior height of the upper cabinet (R–Z). To determine the length of the door tops/bottoms (BB), measure from the outside faces of the sides (R) and subtract 1⅝". Divide the result in half to find the length.

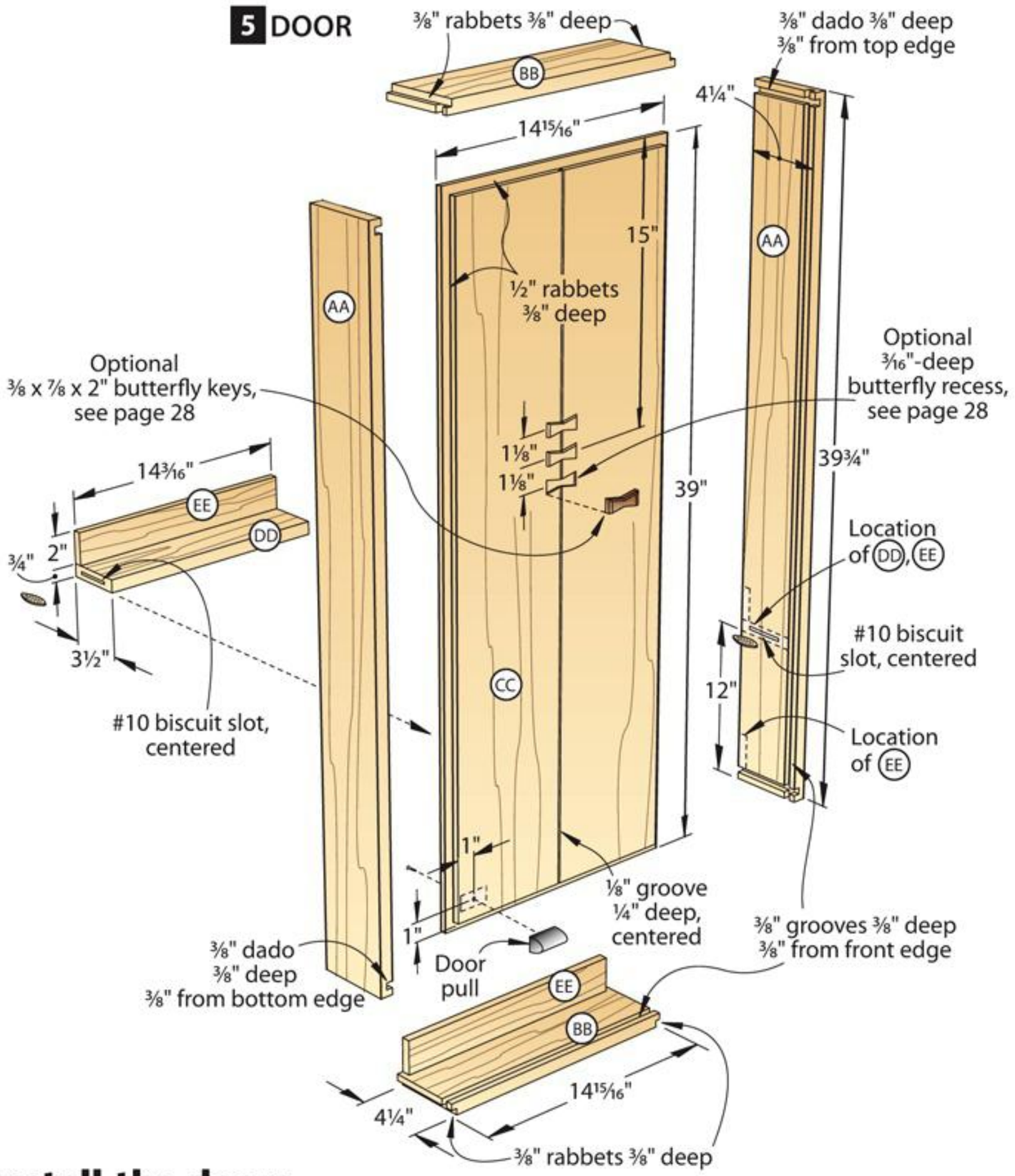
2 ***Note:*** *The doors use locking rabbet joints, similar to those used on the drawers.* Cut ⅜" dadoes ⅜" deep across the ends of the sides (AA) [**Drawing 5**], and the ⅜" grooves toward the front edge of the door sides and tops/bottoms (BB). Attach an auxiliary fence to the rip fence and set it next to the blade. Cut ⅜" rabbets ⅜" deep on the ends of the door tops and bottoms (BB) to create tongues that fit the dadoes in the sides.

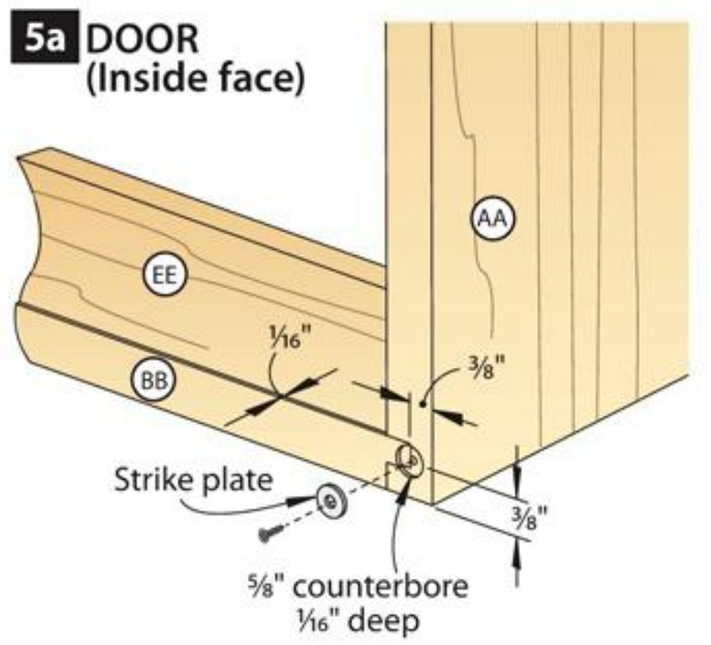
3 Dry-fit the doors and measure for the door panels (CC) and the length of the shelves (DD) and shelf cleats (EE). Switch back to a crosscut blade, remove the auxiliary rip fence, and cut the door panels to size [**Drawing 5**].

4 Remount a ½" dado set and the auxiliary rip fence. Cut a ⅜"-deep rabbet around each door panel (CC) to create a tongue that fits the grooves in the door sides (AA) and tops/bottoms (BB). If you want to add the butterfly-key accents and groove in each door panel, see **Routing Inlays** on *page 28*.

5 Cut the shelves (DD) and shelf cleats (EE) to size [**Drawing 5**]. Lay out and cut the biscuit slots in the door sides (AA) and the ends of the shelves. Sand to 220 grit the inside faces of the door sides, tops/bottoms (BB), and panels (CC), and all surfaces of the shelves and shelf cleats. Set the cleats aside for now.

6 Place one door side (AA) inside face up on your bench. Apply glue to the dadoes at each end and add a door top and bottom (BB). Glue the panel (CC) in next. Apply glue in the biscuit slots in the door side and shelf (DD) and to the rear edge of the shelf, then glue the shelf in place. Add the remaining door side, then, using the cabinet as a helper, square the assembly [**Photo L**]. After the first door dries, assemble the other door the same way. (Save the spacers used under the doors. You'll need them later as you test the doors' fit.) Sand the outside surfaces of the doors to 220 grit. Install the door pulls [**Drawing 5**].





Install the doors and finish it up

1 Cut spacers to support the doors next to the case in the open position [**Photo M**]. Center each door between the upper side trim (X) and lower side trim (W). Cut two pieces of continuous hinge to 39¾". Position a hinge on each door and side (R/S) and install four evenly spaced screws on each half of the hinges. Close the doors so they rest on spacers inside the cabinet. If the fit and swing are good, install hinge screws in every other mounting hole; the remainder will be installed after finishing.

2 Cut a door stop (FF) to shape [**Drawing 4c**]. Drill holes for the magnetic catches and install them. Mark a centerline on the upper cabinet's width. Place a straightedge against the hinge barrels and mark a line intersecting the centerline. Install the door stop aligned with the hinge line and centered on the centerline [**Photo N**]. Swing each door closed, mark the location for the strike plate, and drill the counterbores [**Drawing 5a**]. Screw the strike plates in place.

3 Retrieve the shelf cleats (EE) and glue them to the door shelves (DD) and door bottoms (BB) [**Drawing 5**]. Cut the cabinet shelves (GG) and shelf edging (HH) to size [**Drawing 4**]. Glue the edging to the shelves. After the glue dries, sand the assemblies to 220 grit.

4 Remove the hardware, and sand any areas needing it to 220 grit. Then apply a finish. (We brushed on three coats of boiled linseed oil, buffing lightly with a 320-grit sanding sponge between coats.) After the final coat dries, reinstall the hardware, driving screws in all of the hinge holes. Mount the drawer pulls to the false fronts (P, Q), then screw the false fronts to the drawers but leave the drawers out of the cabinet.

5 Drill mounting holes and slots in the top (E) [**Drawings 3, 3a**]. With help from a friend, lift the upper cabinet onto

THE CABINET SQUARES THE DOORS

With spacers supporting the door, lightly wedge the door in place so it fits the cabinet opening perfectly.

INSTALL THE DOOR HINGES

Clamp the doors to the case with spacers at the top and bottom to establish the gap. Install eight screws before testing the swing.

PLACE THE DOOR STOP

Use a square to align the magnetic catches with the hinge line. Drill countersunk shank holes in the stop, then screw it in place.

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the base and center it from side to side, flush at the back. Secure the upper cabinet with #8×1½" panhead screws and #8 washers. Install the drawers, and your tool chest is ready for years of service and admiring looks.

Produced by **Craig Ruegsegger** with **Jeff Mertz**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine**; **Lorna Johnson**

MORE RESOURCES

FREE VIDEOS

- See how to cut a lock rabbet joint for the drawers at woodmagazine.com/simpledrawer.
- Learn several methods for drilling perfectly spaced shelf-pin holes at woodmagazine.com/shelfholes.

FREE PLAN

- Get a free plan for the squaring braces shown on *page 52* at woodmagazine.com/brace.

RELATED PLAN

- Build a traditional workbench with looks that complement the tool chest. Find the plan at woodmagazine.com/tradbench. $

$ = Download this plan for a small fee.

Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
Base						
A	feet/rails	1½"	3½"	18"	A	4
B	uprights	1½"	3"	28"	A	4
C	stretchers	1½"	3"	32"	A	2
Lower cabinet						
*D	side panels	¾"	18¾"	21¾"	AP	2
*E	top/bottom panels	¾"	18¾"	29¼"	AP	2
*F	side edging	¾"	¾"	21¾"	A	2
*G	top/bottom edging	¾"	¾"	29¼"	A	2
H	back	¼"	29¼"	21"	BP	1
I	divider	¾"	6"	18⅛"	AP	1
Drawers						
J	small sides	½"	2½"	18"	SM	8
K	large sides	½"	4"	18"	SM	6
L	small fronts/backs	½"	2½"	12⅜"	SM	8
M	large fronts/backs	½"	4"	27"	SM	6
N	small bottoms	¼"	17½"	12⅜"	BP	4
O	large bottoms	¼"	17½"	27"	BP	3
*P	large false fronts	¾"	4½"	28¼"	A	3
*Q	small false fronts	¾"	3"	14⅛16"	A	4

*Parts initially cut oversize. See the instructions.

Upper cabinet						
R	sides	¾"	9"	40"	AP	2
S	side edging	¾"	¾"	40"	A	2
T	top	¾"	14"	31½"	AP	1
U	bottoms	¾"	17½"	31½"	AP	2
V	front trim	1½"	2½"	31½"	A	2
*W	lower side trim	1½"	2½"	20"	A	2
*X	upper side trim	1½"	2½"	16½"	A	2
*Y	splines	½"	2 11⁄16"	1"	W	4
Z	back	¾"	30¾"	40¾"	AP	1
Doors						
AA	sides	¾"	4¼"	39¾"	A	4
BB	tops/bottoms	¾"	4¼"	14 15⁄16"	A	4
CC	panels	¾"	14 15⁄16"	39"	AP	2
DD	shelves	¾"	3½"	14 3⁄16"	A	2
EE	shelf cleats	½"	2"	14 3⁄16"	A	4
FF	door stop	1¼"	1½"	3"	A	1
Upper shelves						
GG	shelves	¾"	8⅛"	29⅞"	AP	3
HH	shelf edging	¾"	¾"	29⅞"	A	3

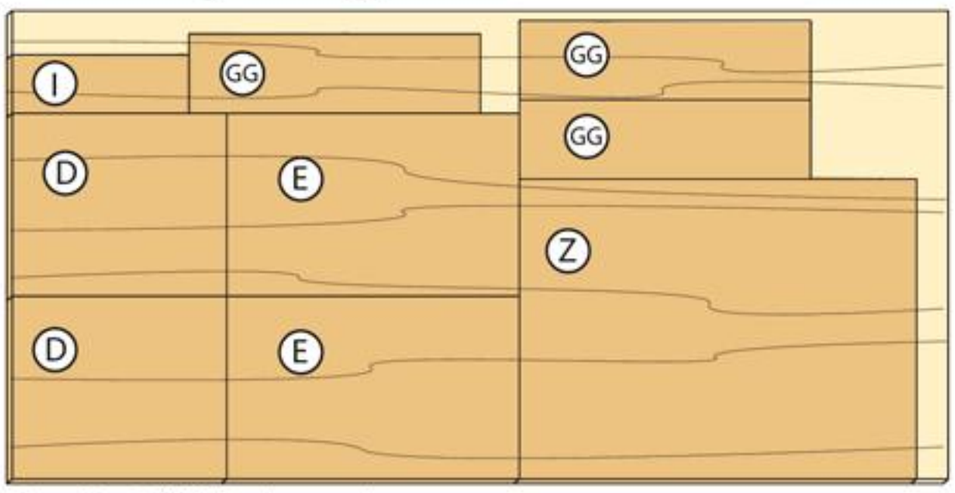
*Parts initially cut oversize. See the instructions.

Materials key: A–ash; AP–ash plywood; SM–soft maple; BP–birch plywood; W–walnut.
Supplies: Spray adhesive, #8×1" flathead wood screws (34), #8×1½" flathead wood screws (40), #8×2" flathead wood screws (2), #8×1½" panhead screws (6), #8 washers (6), #10 biscuits (4).
Blade and bits: Stacked dado set; ¼" slot-cutting, 45° chamfer router bits; ⅛", 3⁄16", ¼", 9⁄16" drill bits; ½", ⅝", ¾" Forstner bits.

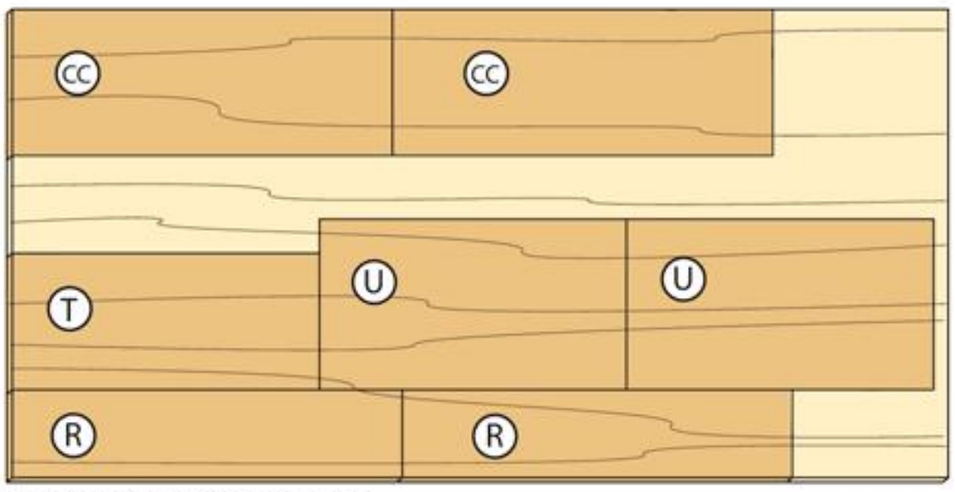
Source

Hardware: 1½×48" continuous hinges (2) no. C11248 14A, $6.30; 96mm Riva graphite drawer pulls (10) no. A55365 GPH, $4.10; Riva graphite door pulls (2) no. A55360 GPH, $3.12; 18" full-extension self-closing drawer slides (7 pr.) no KV8417 B18, $14.71; ¼" nickel shelf pins (12) no. G111NI [pack of 20], $3.80; brass-clad magnetic catches and strikes (2) no. SYMC12 7P, $4.54, Woodworker's Hardware, 800-383-0130, wwhardware.com.

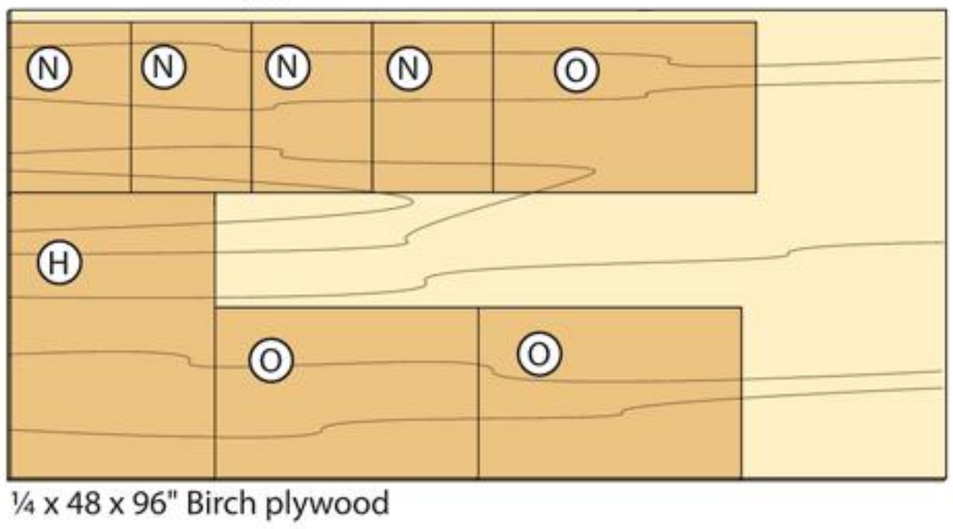
Cutting Diagram



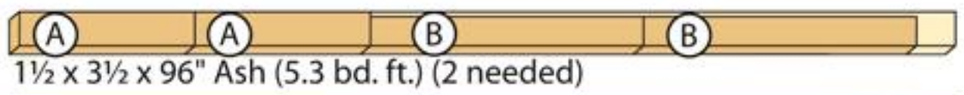
¾ x 48 x 96" Ash plywood



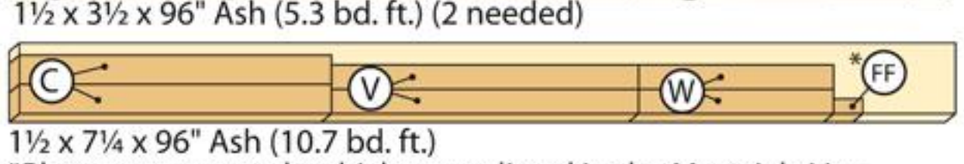
¾ x 48 x 96" Ash plywood



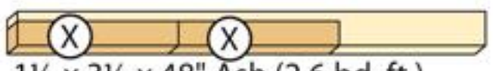
¼ x 48 x 96" Birch plywood



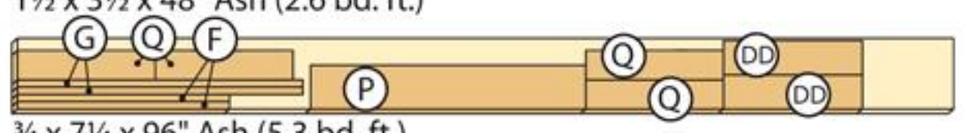
1½ x 3½ x 96" Ash (5.3 bd. ft.) (2 needed)



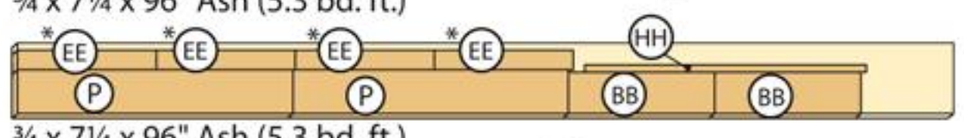
1½ x 7¼ x 96" Ash (10.7 bd. ft.)
*Plane or resaw to the thicknesses listed in the Materials List.



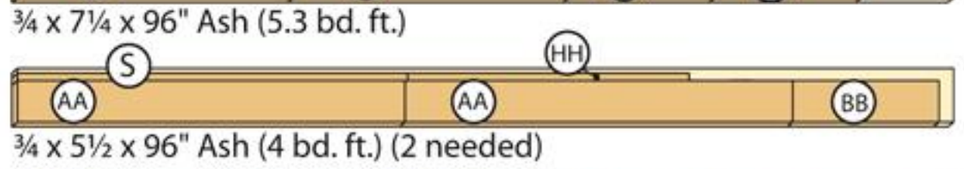
1½ x 3½ x 48" Ash (2.6 bd. ft.)



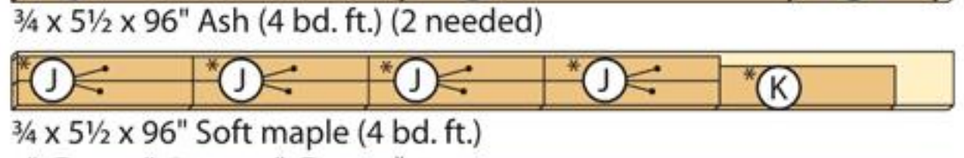
¾ x 7¼ x 96" Ash (5.3 bd. ft.)



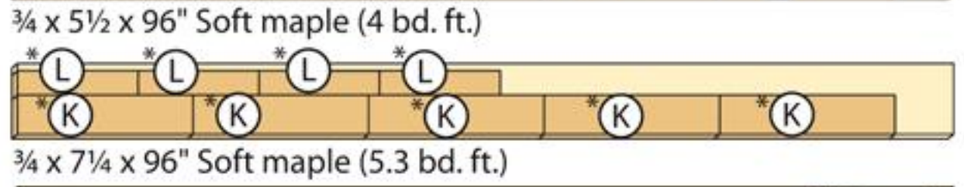
¾ x 7¼ x 96" Ash (5.3 bd. ft.)



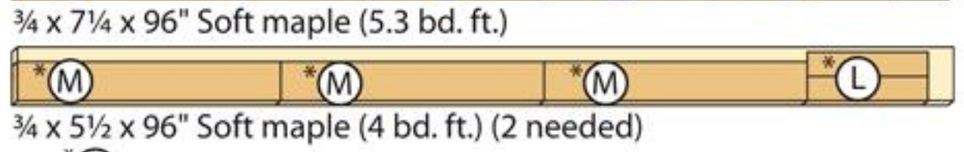
¾ x 5½ x 96" Ash (4 bd. ft.) (2 needed)



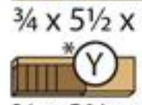
¾ x 5½ x 96" Soft maple (4 bd. ft.)



¾ x 7¼ x 96" Soft maple (5.3 bd. ft.)

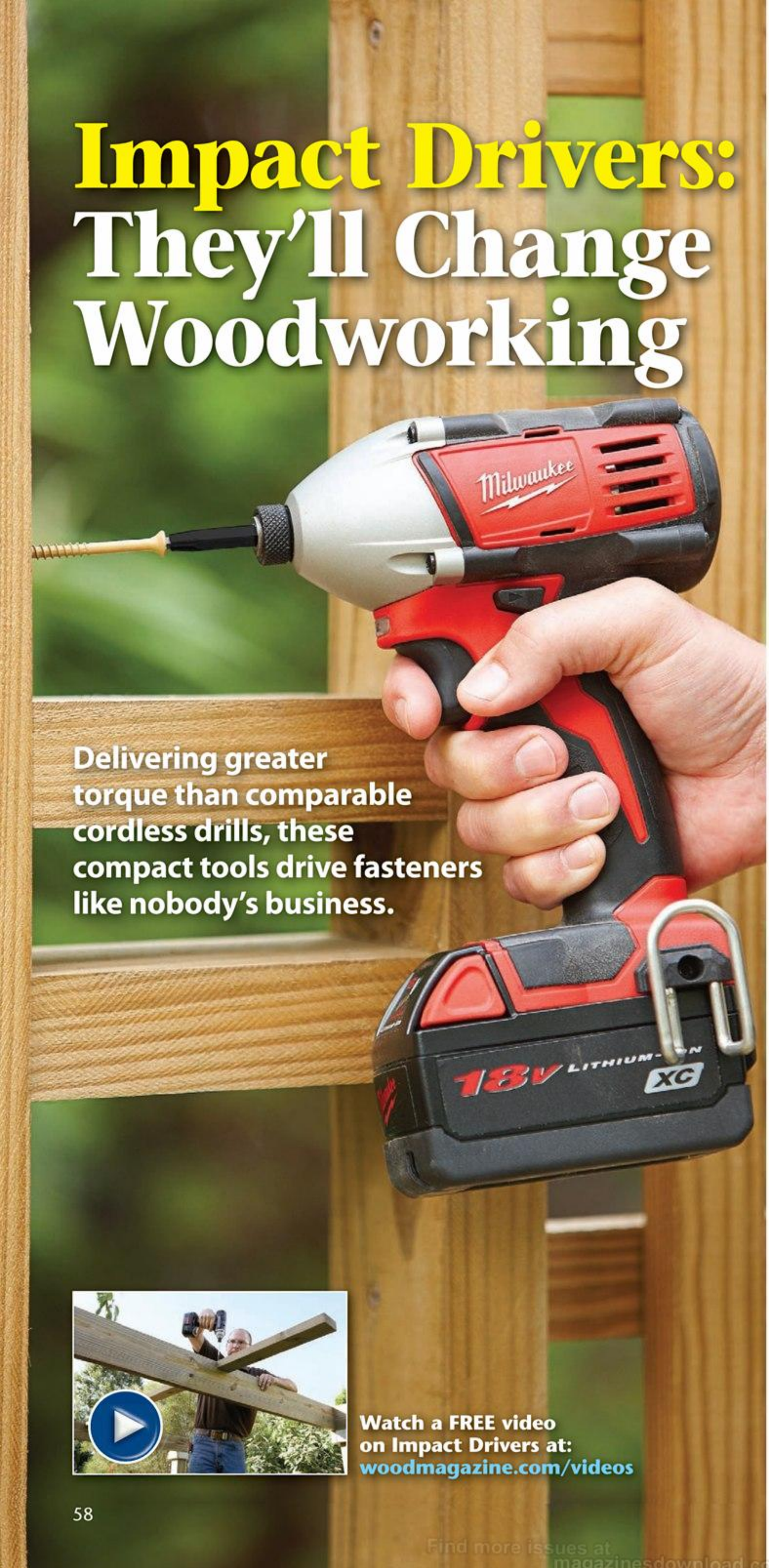


¾ x 5½ x 96" Soft maple (4 bd. ft.) (2 needed)



¾ x 3½ x 12" Walnut (.3 bd. ft.)

Impact Drivers: They'll Change Woodworking



Delivering greater torque than comparable cordless drills, these compact tools drive fasteners like nobody's business.

Watch a FREE video on Impact Drivers at: woodmagazine.com/videos

Your first visit to a tire shop was likely punctuated by the loud BRAP, BRAP, BRAP of a pneumatic impact wrench. Auto mechanics love those tools because they provide loads of torque without jerking the tool when the lug nuts snug up.

Now, you can enjoy similar performance from battery-powered impact drivers. Besides their compact size and high torque, you'll also love how these tools finesse softer fasteners, such as brass screws, without shearing off their heads. So should you dump your cordless drill in favor of one of these bad boys? Let's not go that far. But an impact driver in your shop nicely complements that drill. Here's what you need to know.

Rapid-fire rat-a-tat-tat delivers driving force

Like a typical drill, an impact driver relies—at least initially—on the tool's motor and gearing to turn the chuck for drilling or driving. When the going gets tough, though, an impacter switches modes to engage the hammer-and-anvil system, shown on the *next page*, to kick its rotational power into overdrive. In impact mode, the chuck rotates much slower but with much greater torque. Impact drivers bring a lot of pluses to your shop, along with a few minuses.

Pluses:

- 3 to 4 times greater torque than a drill of equal voltage, yet lighter and smaller.
- Requires less arm strength for tough drilling and driving tasks.
- Fewer stripped screwheads.
- Great for assembling machines and tool stands, and unsticking stubborn screws and bolts.
- Short, powerful turns in impact mode make fastener-depth control easier.
- Drilling with small-diameter bits (less than ¾") works like with a cordless drill because the impact function doesn't kick in unless the wood proves tough.
- Perfect for drilling with large-diameter bits because impact function prevents binding that's common to drills.

Minuses:

- Impact hammering creates loud noise, so have hearing protection handy.
- High speeds with 18-volt models—prior to impact mode kicking in—make for a steep learning curve.
- They only work with ¼" hex-shank bits—a detriment for small-diameter drilling (less than ½") because these bits tend to be of lesser quality.

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IMPACT DRIVERS REQUIRE SPECIAL ACCESSORIES

These impact-duty accessories, made of forged steel rather than cast steel, better withstand the forces of impact drivers.

This standard cast-steel ⅜" socket adapter twisted under an impact driver's torque.

Two things an impact driver is *not*

Despite similar-sounding names, don't confuse an impact driver with these tools:

■ ***Impact wrench.*** Found primarily in auto shops, this unit—pneumatic or battery-powered— functions like an impact driver, but has a square socket-drive instead of the ¼" hex chuck. It provides even greater torque for driving nuts, bolts, and other large fasteners.

■ ***Hammer drill.*** This tool proves almost as noisy as an impacter, but for a different reason. Internally, a small hammer delivers a punching action down the length of the bit—like tapping a screwdriver on the end of the handle—as the chuck turns. This percussive force excels at drilling holes in concrete, but offers little more driving torque than a typical drill.

■ Difficult to gauge screw depth when working in "blind" situations, such as poorly lit areas inside cabinets or inside pocket holes.

■ High torque can twist off screws if pilot holes are too tight or you drive screws too deep. It can also damage ordinary drilling and driving accessories, as shown *above middle*, so look for those made specifically for impact drivers.

Your drill buying decision

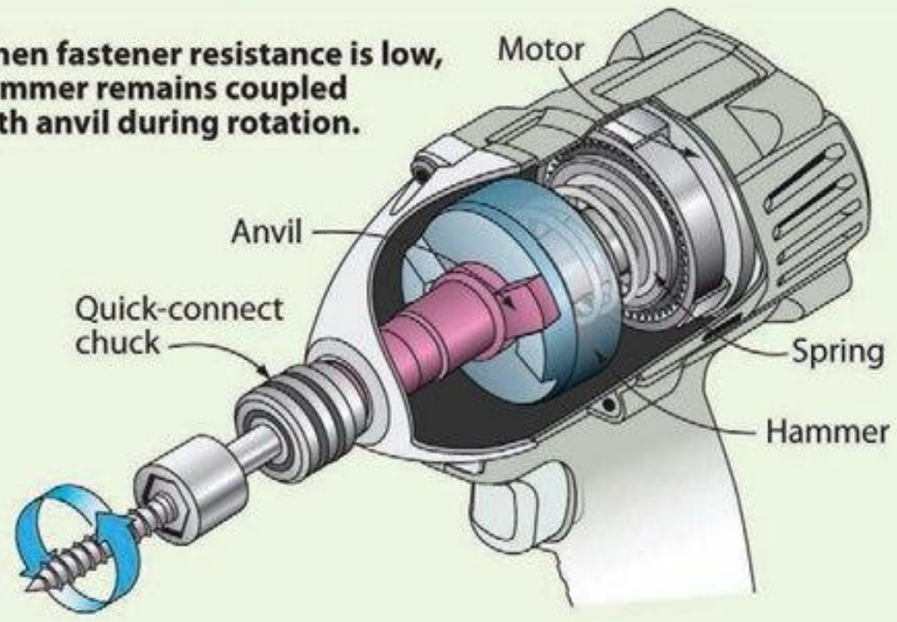
Although an impact driver probably should not be the first cordless tool you buy, a 10.8- or 12-volt model definitely has a place in a woodworking shop, especially for building anything with screws. Its power-to-weight ratio proves second to none, and the slower chuck rotation in impact mode, compared to 18-volt models, provides unparalleled finesse when driving screws to precise depth. But for day-in and day-out drilling duties, we still prefer a standard drill, cordless or electric.

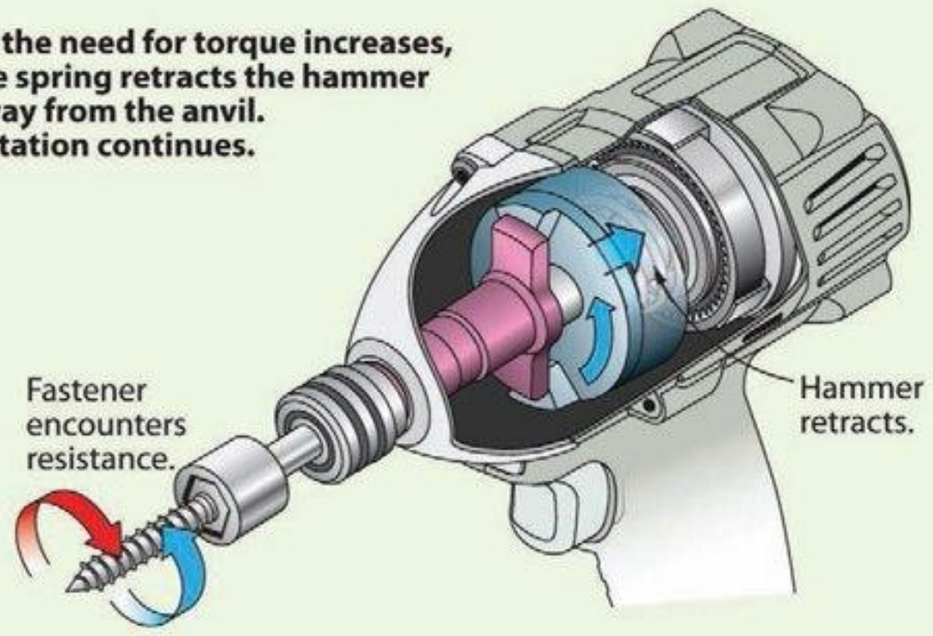
If you build outdoor projects, such as arbors, pergolas, or decks, where you drive a lot of long screws or lag bolts, opt for an 18-volt impact driver. You'll appreciate its added power, and once you become familiar with using it, you can even use it in your shop.

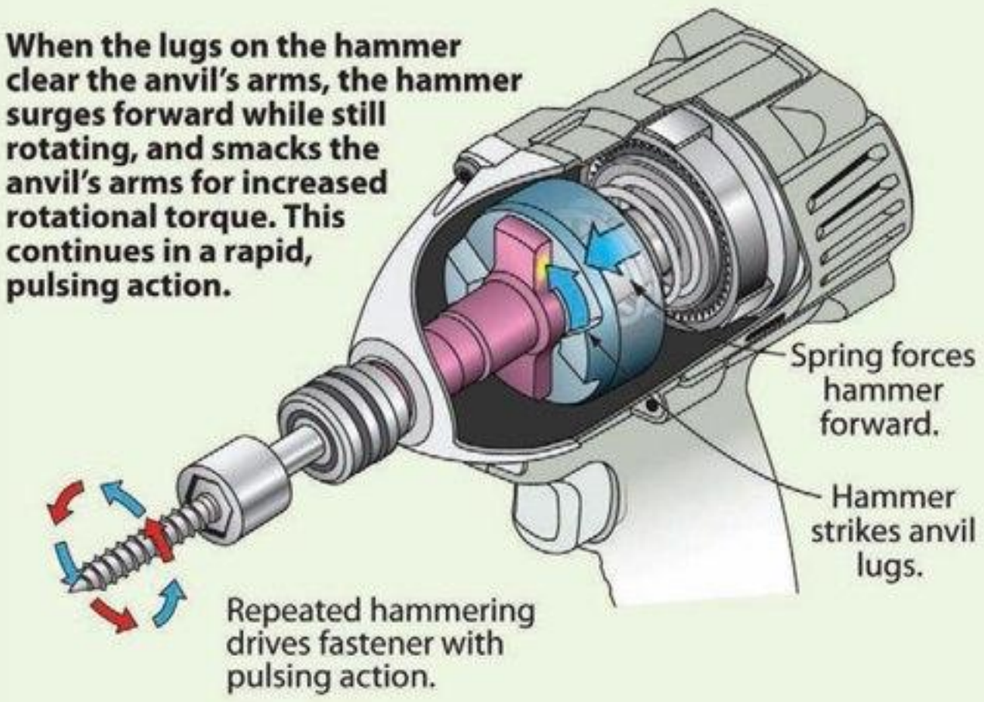
Our advice: When the batteries start to fail on your current cordless drill, consider buying an impact driver with batteries compatible with your old drill. For the cost of the new impacter—about the same as a cordless drill—you'll have both drilling precision and raw power for your shop. You can also buy a cordless impact driver without batteries for about 40 percent less. Or if you'd like to add a new drill as well as an impacter, get a kit that includes both tools with two batteries and a charger. These typically cost about $30 to $50 more than a single drill or driver kit.

Written by **Bob Hunter** with **Kevin Boyle**, **Jeff Mertz**, and **Dave Fish**

How an Impact Driver Creates Torque




As the need for torque increases, the spring retracts the hammer away from the anvil. Rotation continues.
Fastener encounters resistance.
Hammer retracts.


When the lugs on the hammer clear the anvil's arms, the hammer surges forward while still rotating, and smacks the anvil's arms for increased rotational torque. This continues in a rapid, pulsing action.
Spring forces hammer forward.
Hammer strikes anvil lugs.
Repeated hammering drives fastener with pulsing action.

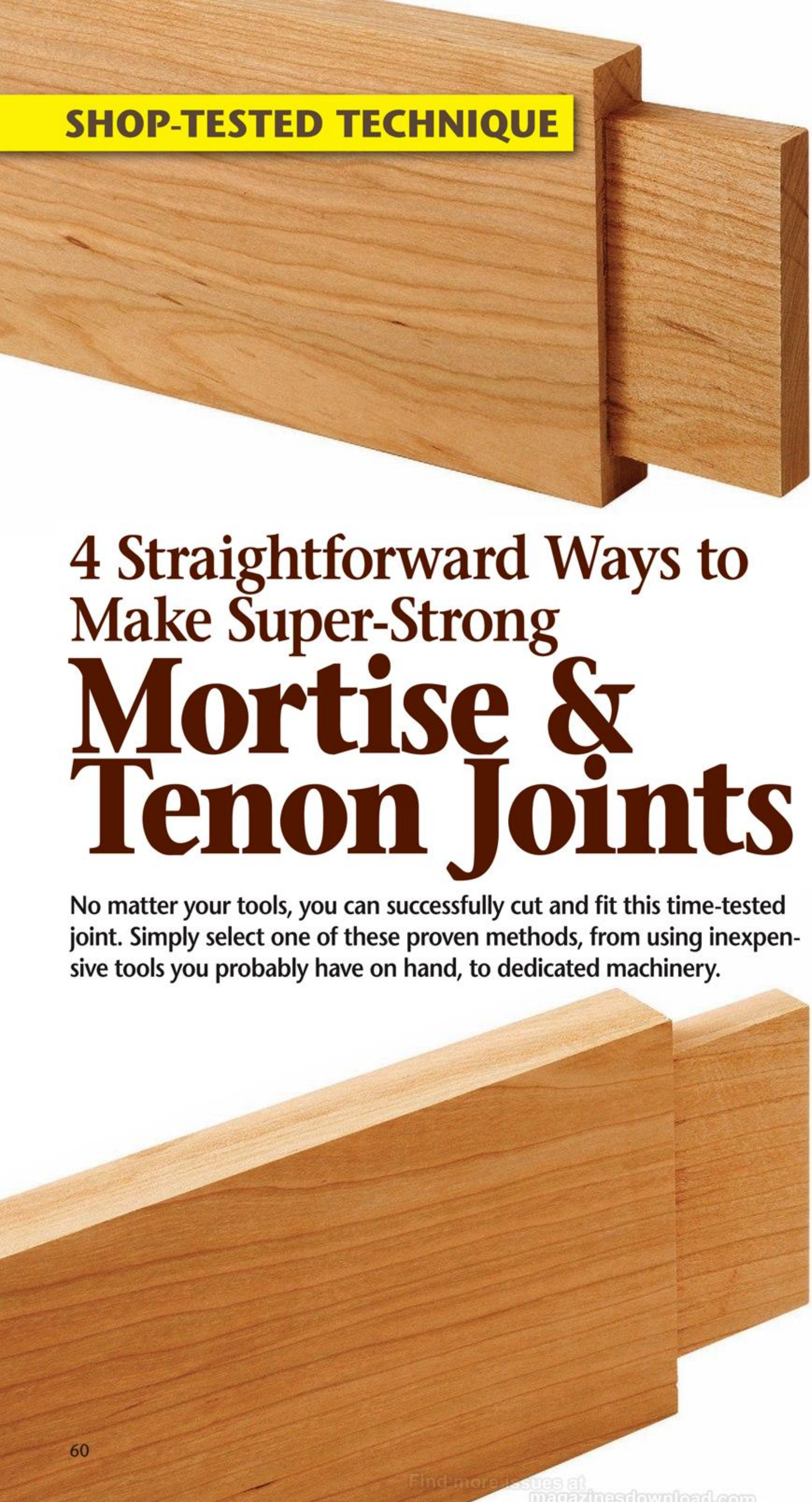
The quick-connect chuck on an impact driver (front) reduces the tool's size, but limits you to ¼" hex-shank drilling and driving bits.

SHOP-TESTED TECHNIQUE

4 Straightforward Ways to Make Super-Strong

Mortise & Tenon Joints

No matter your tools, you can successfully cut and fit this time-tested joint. Simply select one of these proven methods, from using inexpensive tools you probably have on hand, to dedicated machinery.



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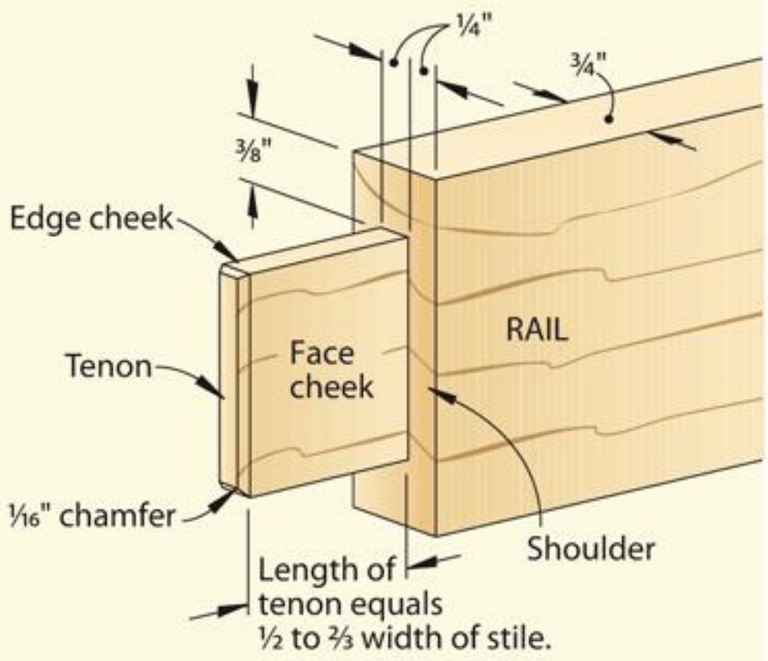
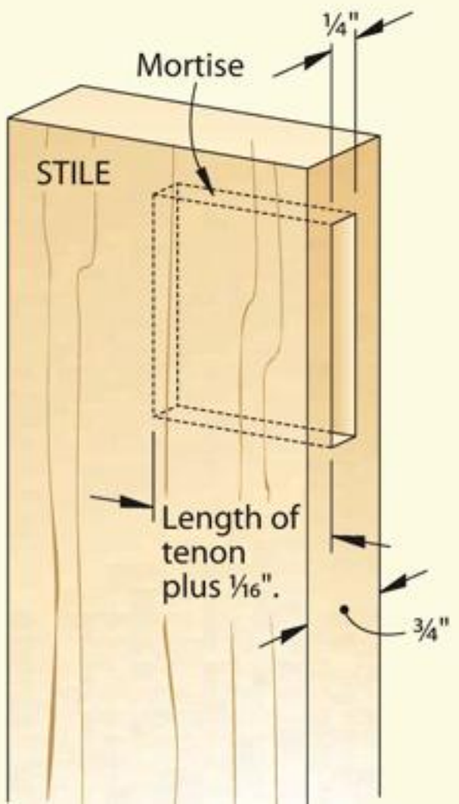
Start here: Ground rules for mortise-and-tenon joints

Regardless of how you cut your mortises and tenons, these tips will help guide you toward perfect-fitting, stronger joints for all your projects:

- Great mortise-and-tenon joints always begin with accurate layout. Use a reliable steel rule and square, and a sharp pencil, marking gauge, or marking knife to make the layout marks.
- The rule of thumb for laying out a mortise in end or edge grain is to divide the mortised workpiece into thirds. The two outer thirds will be the mortise walls, and the middle third will be cut away. So for a ¾"-thick board, as shown *below*, cut a ¼"-wide mortise centered on the ¾" edge. For stock thicker than ¾", you can make the mortise wider than one-third the thickness of the stock; just leave the mortise walls at least ¼" thick for strength.
- Cut your mortises first and then make your tenons to match. It's easier to fine-tune a tenon's size than a mortise's.
- You'll get the best glue bond from joints with smooth surfaces.
- A proper-size tenon should be tight enough—in a dry fit—to remain in a mortise when turned upside down yet require only slight hand pressure to insert or remove it.
- Drilled-out or routed mortises will have rounded ends. You can square them with a chisel to fit a rectangular tenon. Or save time and effort by simply making rounded tenons to match, as shown on *page 64*.





Make the Mortises First

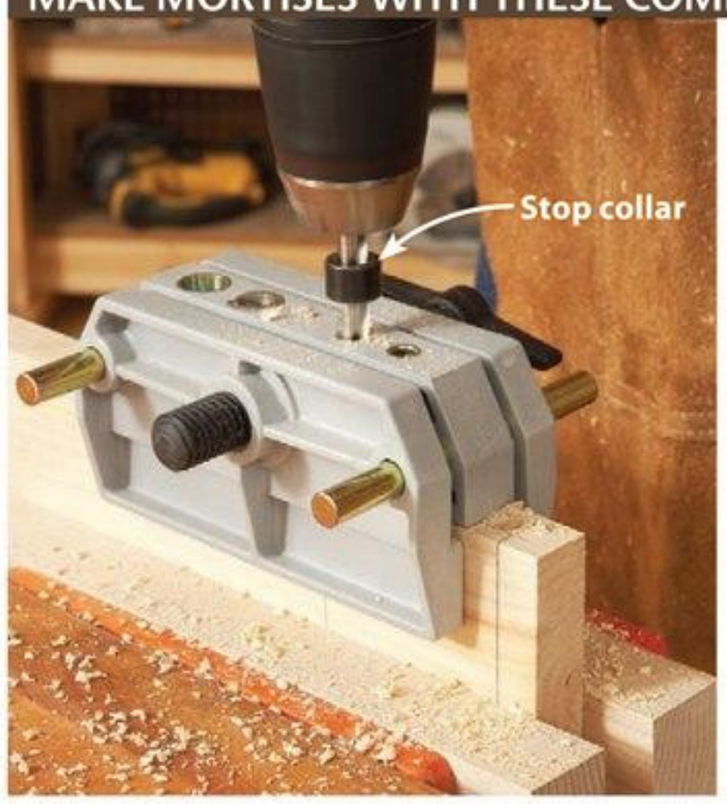
Method #1: Low-tech and simple doweling jig

The first two mortising methods involve drilling a series of overlapping holes and then removing the waste between them. Those holes must be perpendicular to the board's edge—the perfect job for a doweling jig. That's especially true when mortising ¾"-thick stock, where the ¼" drill bushing common to most jigs sizes the mortise just right. (Most doweling jigs come with ¼", 5/16", and ⅜" guides; some include one for ½" bores.) If your doweling jig didn't come with a drill bushing, get a brad-point bit because it cuts cleanly without surface tear-out.

To make a mortise, clamp the jig to drill a hole at one end of the marked mortise, with the hole just kissing the end and side layout lines. Drill to your preset depth. Repeat for the other end of the mortise, as shown *below left*. Then reposition the jig and drill out holes between them without overlapping. Now go back and center the jig on the areas between the holes and drill again.

After you've drilled out most of the waste, clean up and flatten the side walls with a chisel, the widest that will fit, as shown *below*. If you prefer square-end mortises, clean the ends with a chisel as wide as your mortise.

MAKE MORTISES WITH THESE COMMON TOOLS



Install a stop collar on the drill bit to limit the hole depth. If you don't have a stop collar, use a masking-tape flag.

Hold the chisel 90° to the board edge and make light cuts down the mortise walls. A sharp chisel won't need a mallet.

Method #2: Same concept, bigger drilling machine

If you own a drill press, use it instead of a doweling jig and portable drill for greater speed and accuracy. You'll need a fence—it can be as simple as a straight board clamped to your drill-press table—to locate the mortise and keep it parallel with the workpiece edges. Use a square to make sure the table sits perpendicular to the bit's shank. Install a brad-point bit or a Forstner bit because their center spurs prevent them from drifting off target. Set the drill-press depth stop to fix the mortise depth.

As with the doweling jig, start the mortise by boring a hole at each end. Then leave about ⅛" space between holes as you bore out the middle, as shown at *right*. When finished drilling, flatten the sides and ends with chisels.

CONNECT THE DOTS

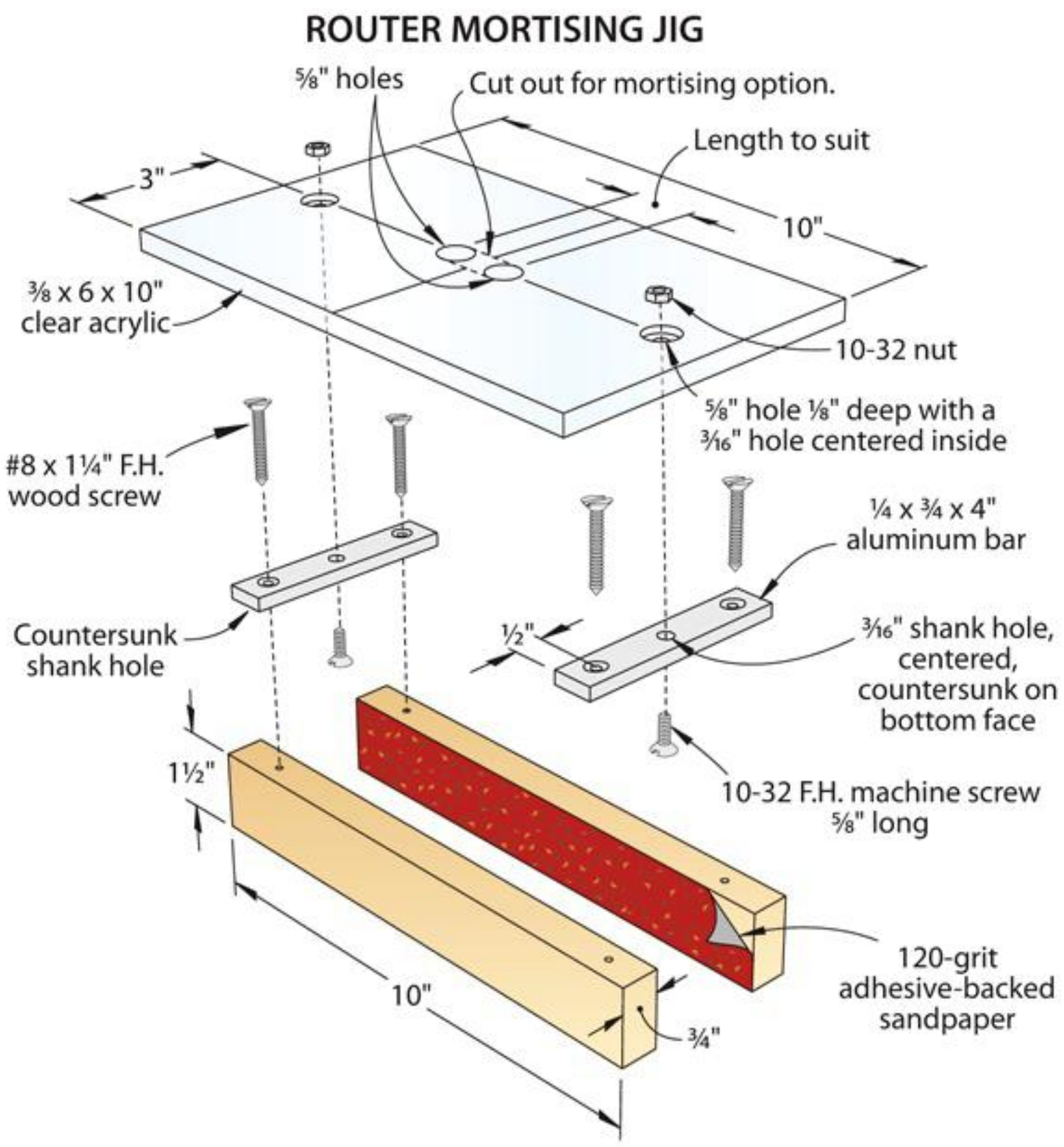
The space left between holes provides a firm starting point for the drill bit as you bore out the remaining waste.

Method #3: Take the plunge—with a router

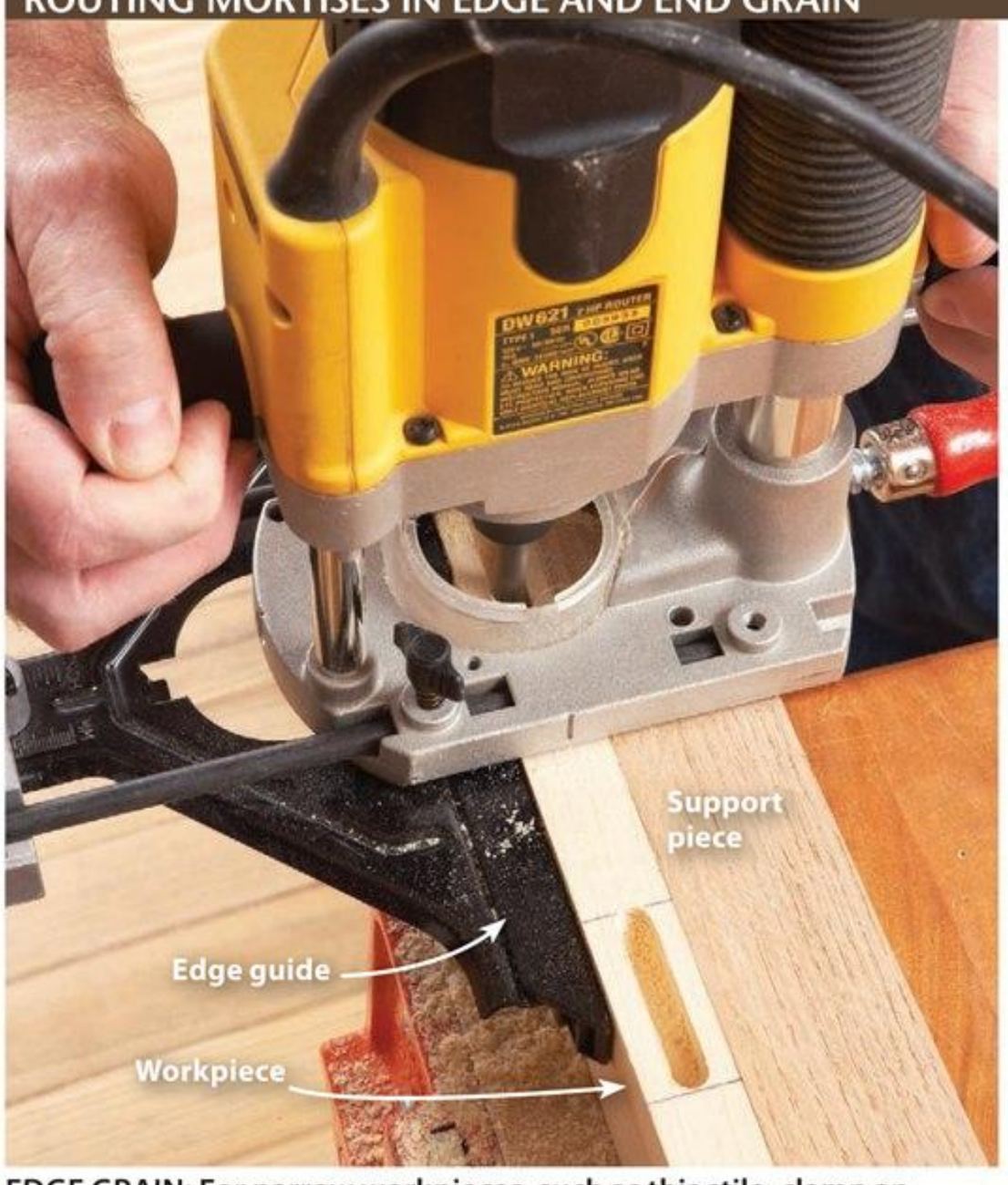
This technique calls for routing a slot in ¼"-deep increments. In addition to a plunge router, you'll need a sharp bit—we recommend upcut spiral bits—and either an edge guide or jig to keep the router bit within the layout lines. You can eyeball the start and end points of the mortise, or clamp on stopblocks to limit side-to-side travel.

Whether shop-made or store-bought, a router-mortising jig, like the one at *right*, proves a versatile addition to any shop. You can easily align the clear acrylic top's scribed centering lines to workpieces. When making a jig, cut the mortising slot slightly longer and wider than the actual mortise to allow for the offset between the bit and the guide bushing that rides in the jig slot.

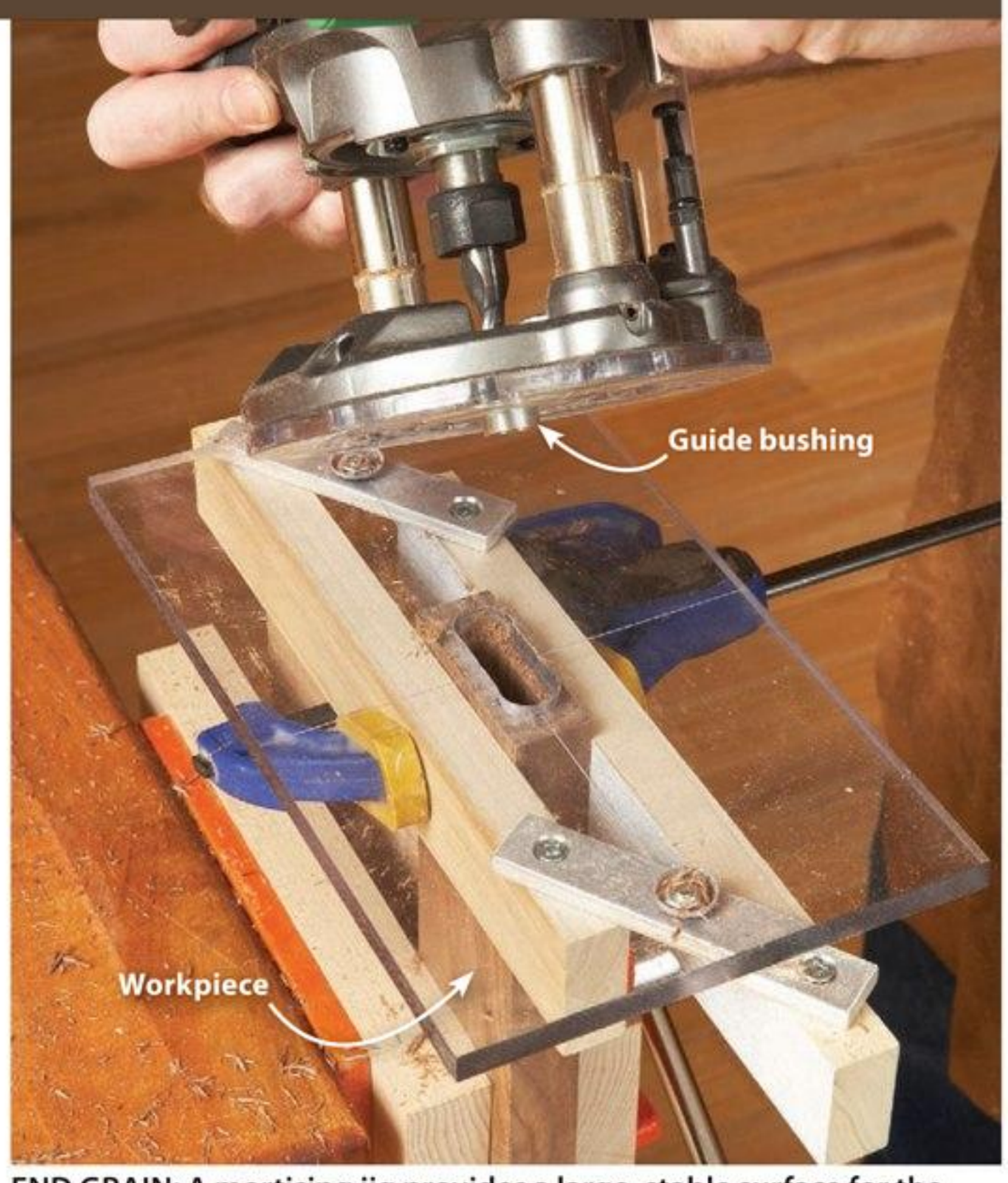
The added expense of a store-bought jig buys you fast setup and flexible mortise sizing. We recommend the Mortise Pal and the Leigh Super FMT. The self-clamping Mortise Pal, $170 (619-459-7951, mortisepal.com), comes with six templates for different mortise widths and lengths, with additional templates available for more options. With the benchtop Leigh Super FMT ($450, 800-663-8932, leighjigs.com), you rout both the mortise and tenon with the same setup. This jig comes with guides and bits to make five sizes of mortises and tenons, but you can buy optional guides for more variety.



ROUTING MORTISES IN EDGE AND END GRAIN



EDGE GRAIN: For narrow workpieces, such as this stile, clamp an auxiliary support piece to it to prevent the router from tipping.



END GRAIN: A mortising jig provides a large, stable surface for the router when routing mortises into the ends of workpieces.

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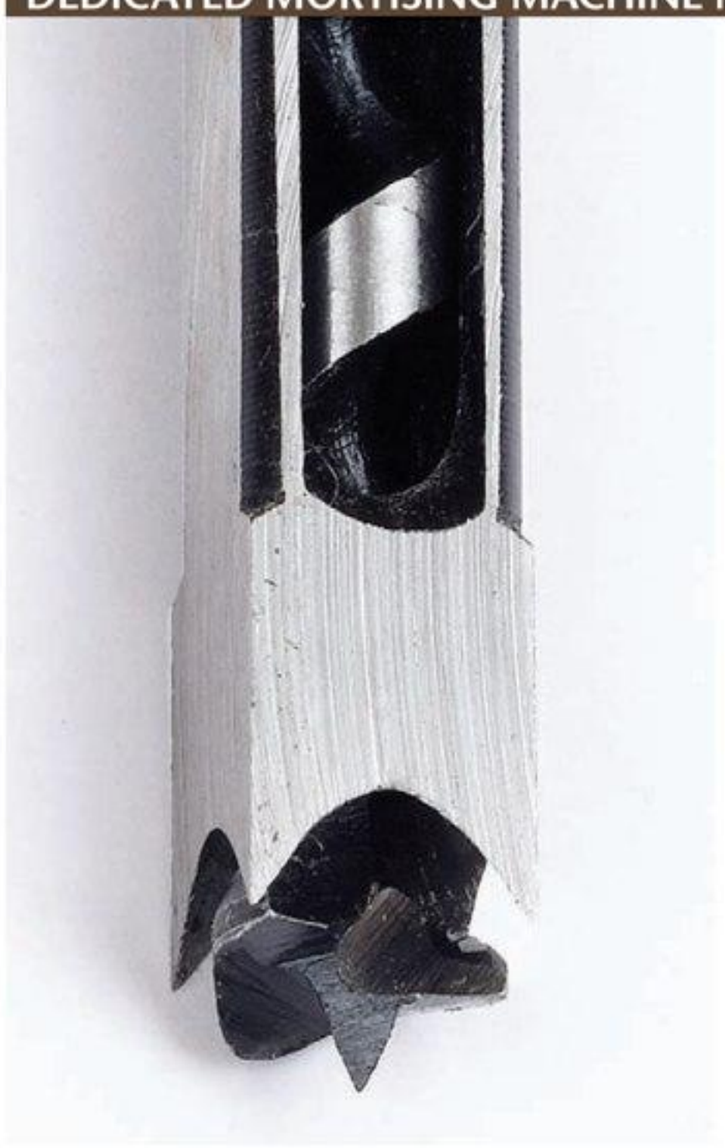
Method #4: Drilling square holes has never been easier

Okay, technically you aren't really *drilling* square holes with a mortising machine. You're actually *chiseling* a square mortise around a round hole as you drill it, using a special auger bit inside a hollow chisel, like the one shown *near right*. Although this technique cuts mortises quickly, it also can be the costliest. Benchtop mortisers should handle nearly all your mortising needs and sell for about $225 to $500; floor-standing mortisers start at $900. (Be aware that some dedicated mortisers do not include chisels and bits; these cost $10–$30 apiece, with four-piece sets starting at $40.)

Here's how a mortising machine works. First, install a drill bit/chisel into the mortiser. Set the mortiser's depth stop to establish the mortise depth. Position the fence parallel to the chisel so the chisel cuts precisely between the layout lines. Begin by cutting the two ends. Then cut out the middle in overlapping bites.

If you like this concept but simply can't commit to a dedicated mortising machine, consider a mortising attachment for your drill press. One of these costs from $65 to about $125. It mounts to the quill, as shown at *right*; then it works exactly like a mortising machine. The drawback: You won't be able to use your drill press for other drilling chores without removing the attachment.

DEDICATED MORTISING MACHINE MAKES REPEATABLE, ACCURATE CUTS



The steep flutes on the drill bit evacuate chips quickly so the surrounding square chisel can slice the walls cleanly.

The long handle on a mortising machine provides added leverage to drive the chisel into the wood.

FROM DRILL PRESS TO MORTISER

In about 20 minutes, you can convert your drill press into a mortiser by adding an accessory mortising attachment to the quill.

ONE-MINUTE MORTISES

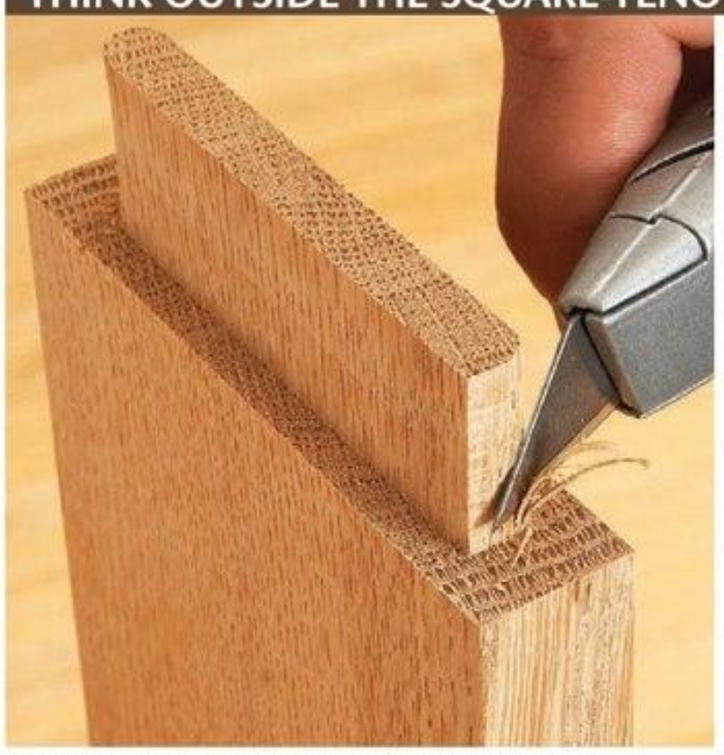
Once you set up your mortiser, you can chisel out mortises like this in a minute or less.

Now Make Tenons to Fit the Mortises

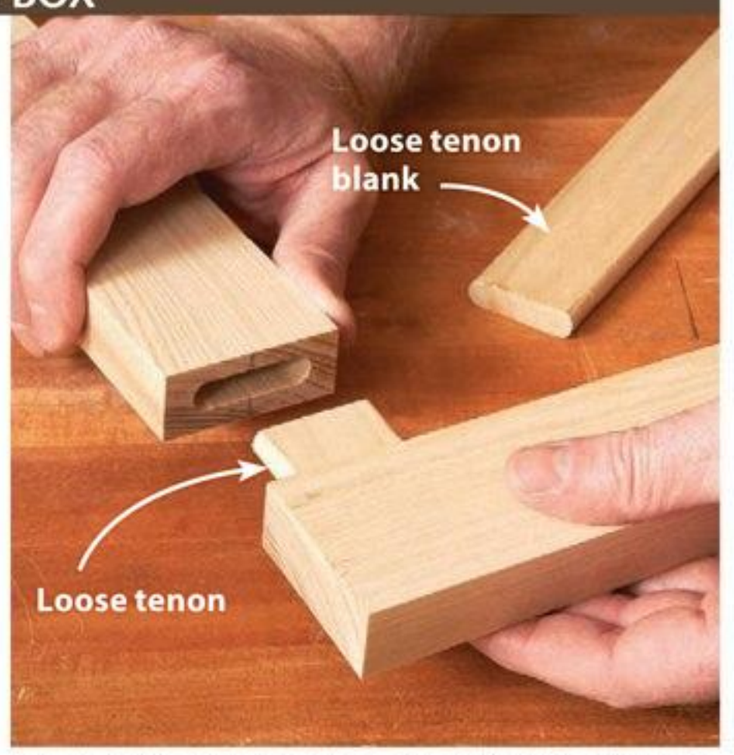
Depending on the mortise method you used and the available tools in your shop, you have a choice between integral tenons—a narrowed end of a workpiece that fits into a mortise—or loose tenons, a separated tenon that joins two mortised workpieces.

With loose tenons you make mortises in mating workpieces, and then insert a tenon cut to fit inside both, as shown at *far right*. Rather than buying premade loose-tenon stock, make your own from scrap hardwood, preferably at least 12" long for safer handling. Simply plane the stock to a thickness that fits snugly in the mortises. If your mortises have rounded ends, rout matching roundovers onto your tenon stock. Then, cut tenons to length to fit the mortises.

THINK OUTSIDE THE SQUARE-TENON BOX



Fitting an integral tenon to a rounded mortise is easier than squaring the mortise. use a utility knife or rasp to round corners.



Loose tenons prove a good option for routed mortises. Cut loose tenons to length from a longer blank you've machined to size.

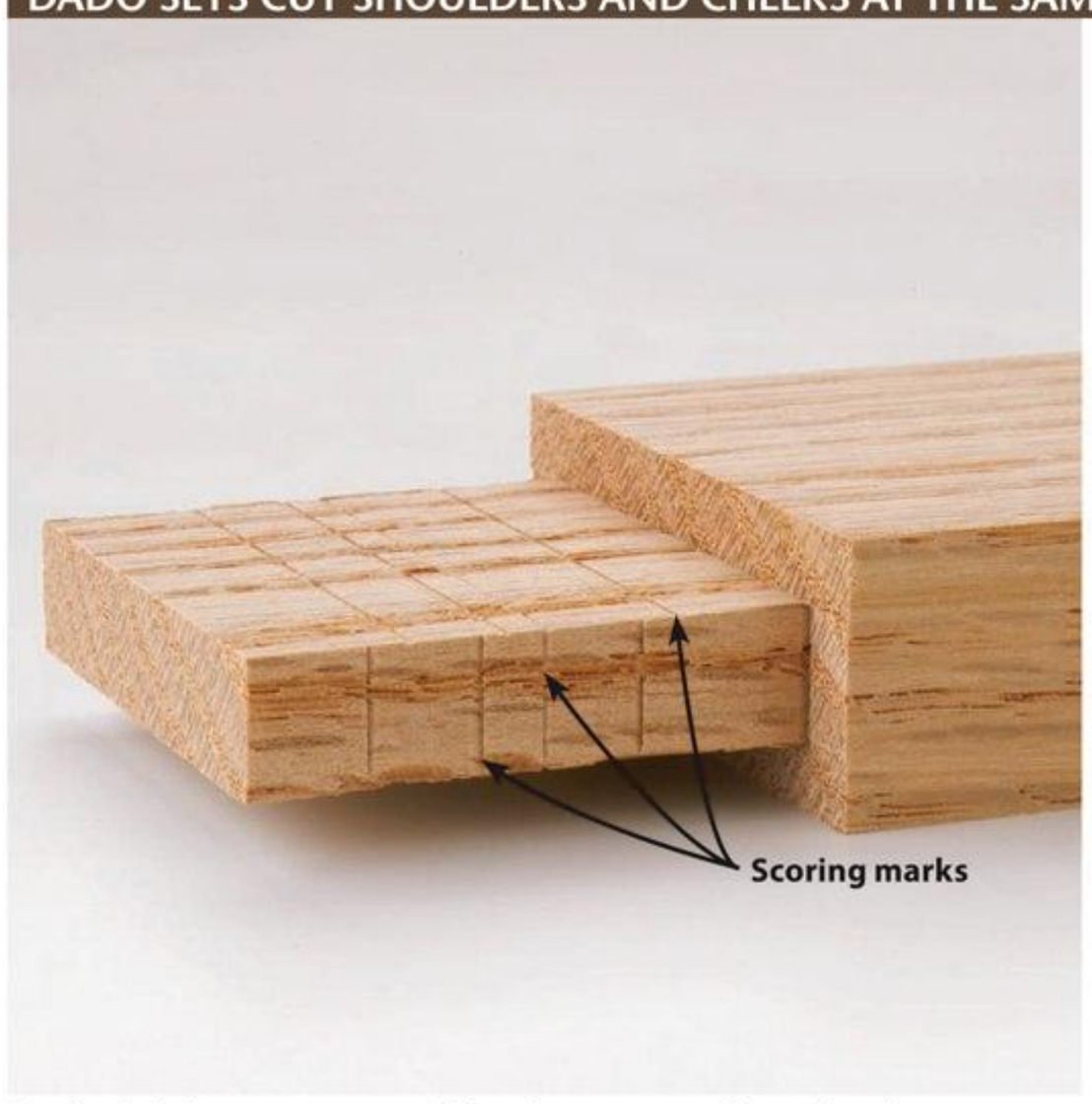
Method #1: Dado set helps you tackle tenons quickly

A stacked dado set allows you to make precise-fitting tenons in no time. You don't need to set the stack to a precise width because repeated passes remove the waste. To cut tenons this way, install the two outer blades with three ⅛" chippers between. Add a plywood or MDF extension to your miter gauge to prevent grain tear-out where the blades exits the workpiece.

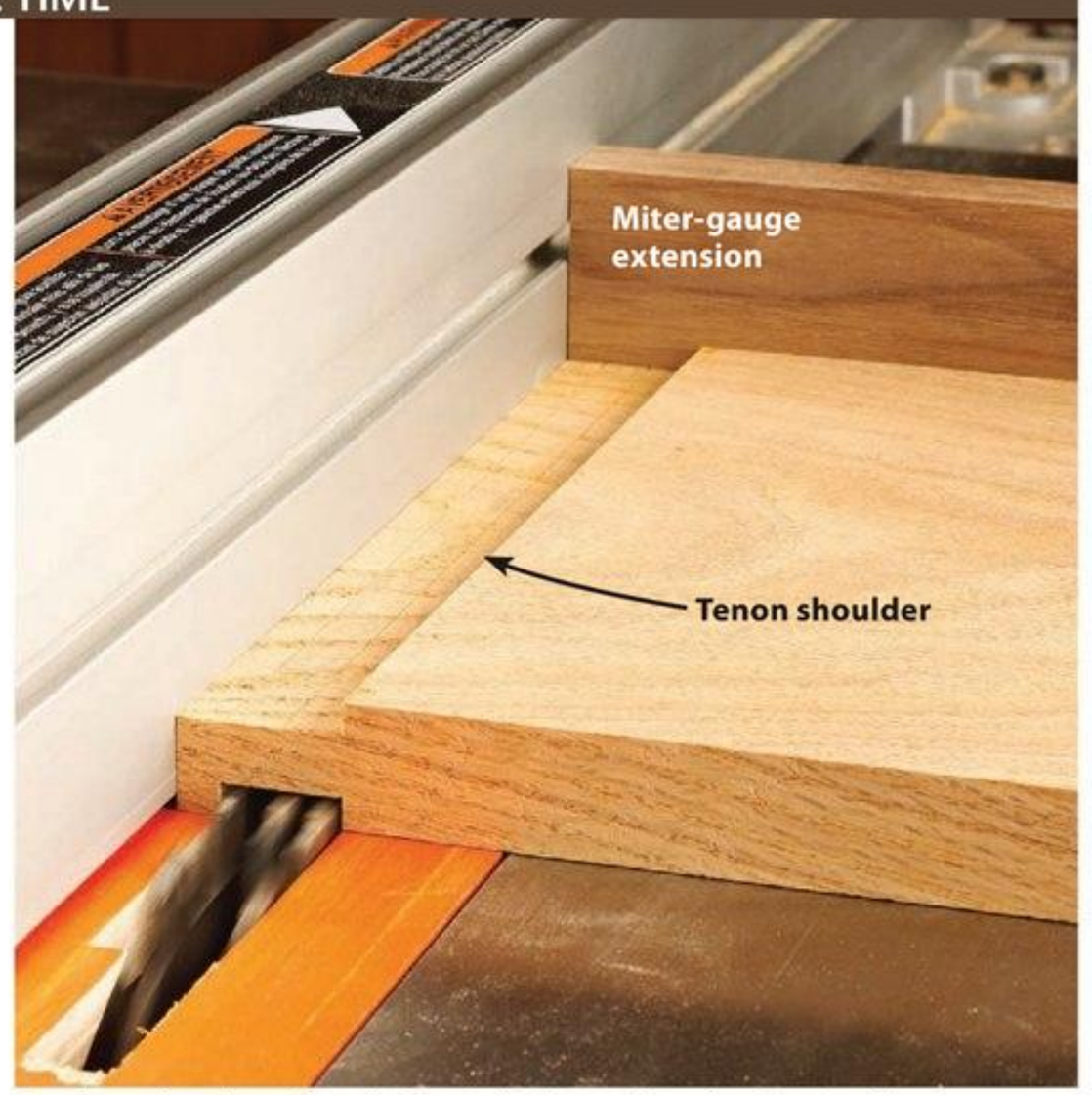
With your dado stack installed, set the blade height to cut just shy of your tenon layout mark. Cut a pass on each face in scrap stock the same thickness as your tenon stock; then, check the fit in the mortise. Adjust the blade up or down and make more test cuts until you've got a snug fit.

Next, set your rip fence to be the stop-block that defines the length of the tenon. Measure from the fence to the teeth of the outer blade farthest from the fence to define the tenon shoulders. As long as you've aligned the fence parallel to the blade and miter slots, your workpiece shouldn't bind or kick back during the cut. Cut both face cheeks with this setup for all pieces. Then, without moving the rip fence, repeat the procedure for the edge cheeks, adjusting the blade height as needed to get the correct tenon width. When finished, remove scoring marks with a shoulder plane or sanding block.

DADO SETS CUT SHOULDERS AND CHEEKS AT THE SAME TIME



Stacked dado sets prove quick and easy to use, but often leave scoring marks that require post-machining cleanup.



Cut face cheeks with a dado set before edge cheeks. A tall miter-gauge extension supports the workpiece on edge-cheek cuts.

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Method #2: Tenoning jig makes smoothest tenons

For about the same cost as a good dado set ($100–$150), a tenoning jig, such as the one shown at *far right*, delivers smoother tenon cheeks. Set the blade height to the shoulder width. Then, using your miter gauge to guide the workpiece, cut all four tenon shoulders, as shown at *near right*, changing blade height, if needed, for the edges. This ensures clean, crisp shoulders.

To make the cheek cuts, simply clamp your workpiece standing on end into the jig, adjust the jig to align the layout lines with the blade, set the blade height, and make the cut. Flip the board and cut the opposite cheek for a perfectly centered tenon. (You'll need to make separate setups for offset tenons.) You also can cut angled tenons with one of these jigs by tilting the rear fence.

Here again, you can save money by building your own tenoning jig. Choose from several plans, some for free, at woodmagazine.com/tenonjigplans.

TWO STEPS TO SUPERSMOOTH TENON CHEEKS

Make the tenon-shoulder cuts first, holding the workpiece square with your miter gauge and using the fence as a stopblock.

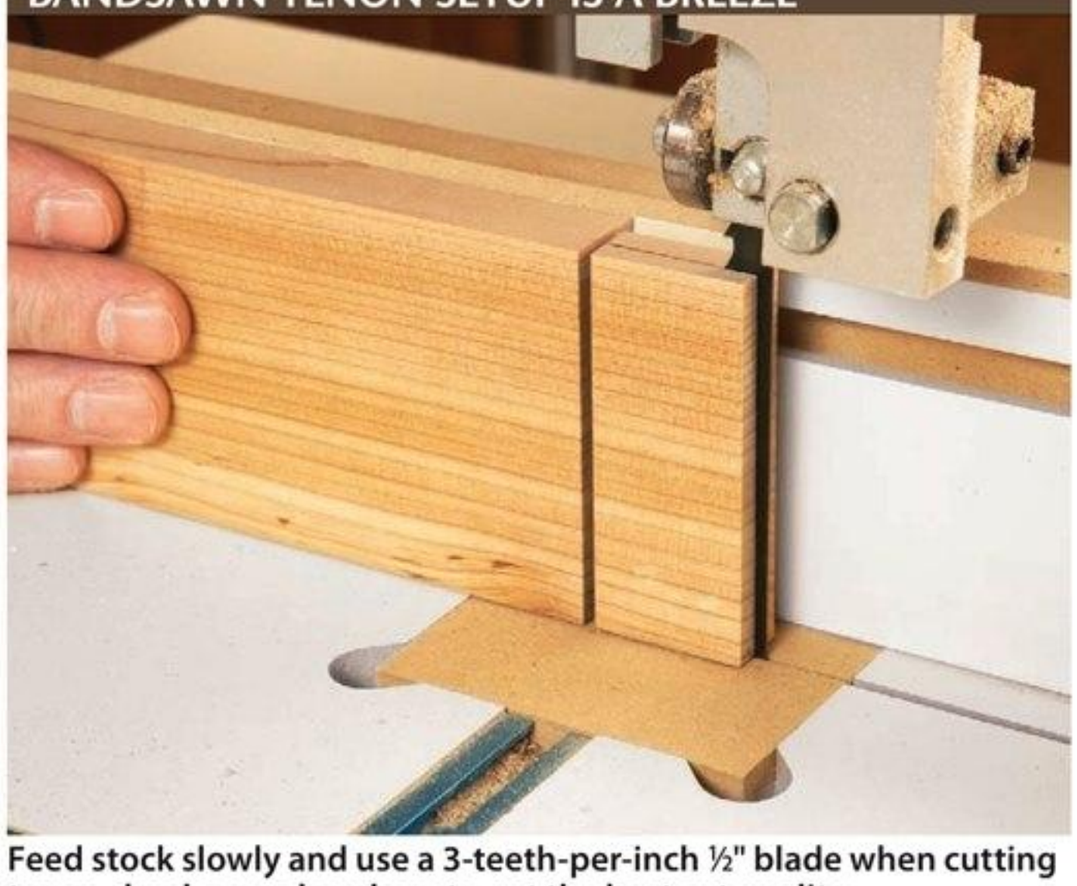
Set your tenoning jig so the tenon-cheek offcut falls away from the blade, not trapped between the blade and jig.

Method #3: Your bandsaw makes quick work of tenons

You can set up to cut tenons on a bandsaw as easily as setting up a common rip cut. But before doing this, cut the shoulders on your tablesaw as described in Method #2. Then, align your bandsaw fence so the tenon will be about 1/32" thicker than needed, and make the cut, as shown *below*.

When ripping away the tenon cheeks, feed the board slowly to minimize any blade deflection, which can create curved tenons. Take care to stop feeding the workpiece into the blade when the cutoff falls away; you don't want to accidentally cut into the shoulders. Bandsawn cheeks will be slightly rough, so smooth them with a sanding block or shoulder plane for best glue adhesion.

BANDSAWN TENON SETUP IS A BREEZE



Feed stock slowly and use a 3-teeth-per-inch ½" blade when cutting tenon cheeks on a bandsaw to get the best cut quality.

Method #4: Who needs a tablesaw when you have a router table?

You can make smooth, accurate tenons on your router table with a single bit, miter gauge, and fence. First, install the largest diameter straight bit or mortising bit you have, and set the height to the tenon layout lines. Position your table's fence to serve as a stopblock set for the precise tenon length. Align the fence parallel to the miter slot to ensure tenon shoulders square to the workpiece edges.

Once set up, begin by routing a pass along the end of the tenon. Make successive passes until the end of the workpiece rides against the fence. (Routing the shoulder first could create a trapped cut on successive passes that might jerk the board from your grip.)

Written by **Bob Hunter** with **Kevin Boyle** and **Jeff Mertz**

TABLE TENONS MADE EASY

Leave a slight opening between your router-table fence panels so your shop vacuum can suck away the chips.

Bright and Cheery Turned Christmas Ornament

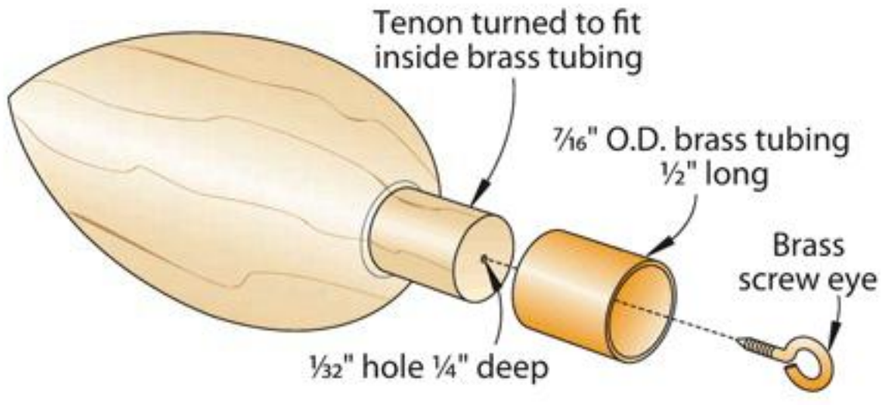
This quick-to-make lightbulb ornament is sure to brighten up the holidays.

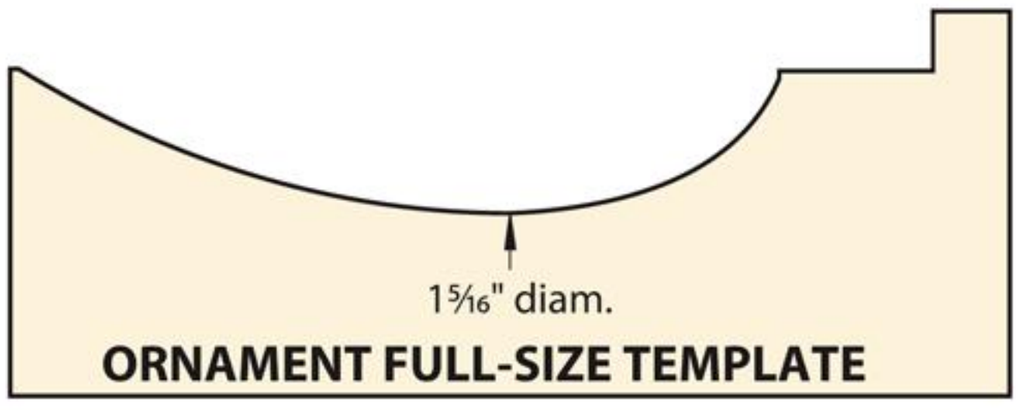
Whether you choose to stain them an assortment of colors as shown or make them out of different-colored wood species, you can quickly turn out a tree full of these delightful Christmas ornaments for many seasons of holiday cheer.

Watch a FREE video on turning this project at woodmagazine.com/turnedbulb

1 Gather the materials

For each ornament, you'll need a 1⅜×1⅜×3¾" blank in your choice of wood for the bulb. We made 12 ornaments from a single 3×3×12" basswood blank from our local hobby shop. You'll also need 7/16" O.D. brass tubing for the bulb's screw base, a small brass screw-eye for the hanger (we used National #217½ from our local hardware store), and a ⅛"-thick hardwood scrap to be used as a marking gauge. To make the turning template, photocopy the **Ornament Template** *below*. Adhere the template to cardboard with spray adhesive, and cut it to shape with a crafts knife.





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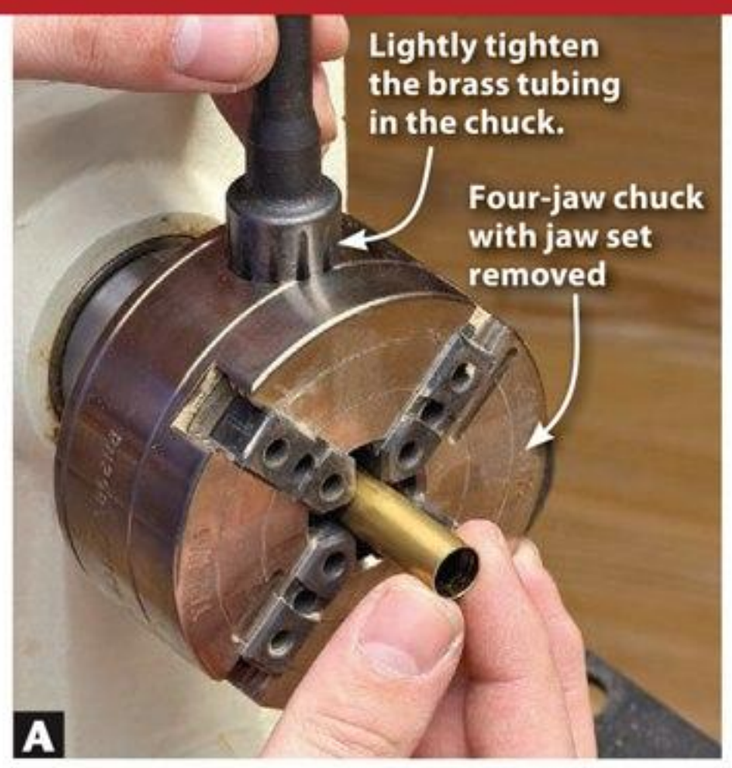
2 Start with the brass

Tools: 1/16" parting tool
Tool rest: Slightly below center
Speed: 1,000 rpm

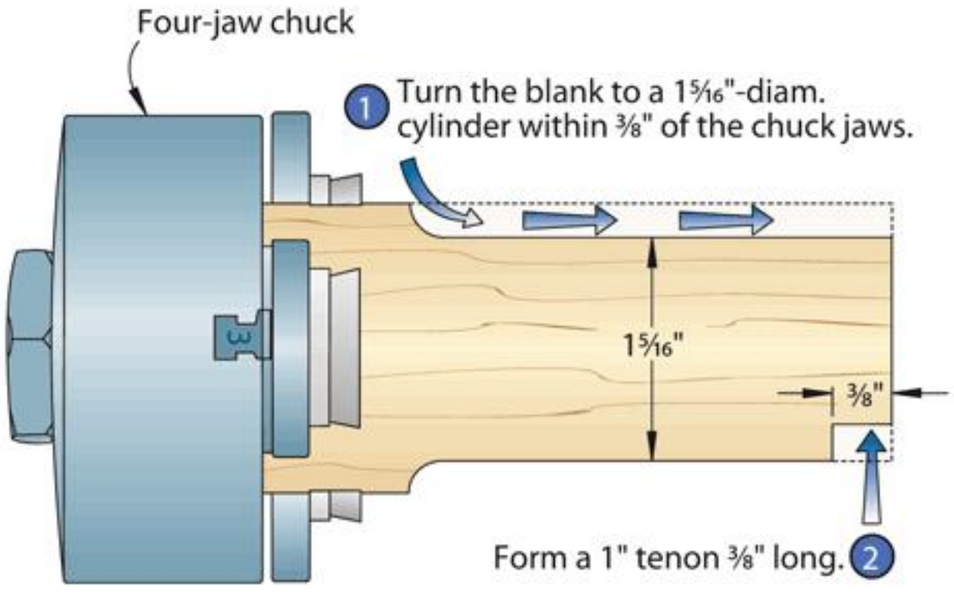
Using a hacksaw, cut the 7/16" O.D. brass tubing to 4" in length. Remove the jaw set from your four-jaw chuck. Then, mount the tubing directly into the center of the chuck, leaving about 1" protruding [**Photo A**] and tightening lightly to avoid crushing the tubing. Turn on your lathe and cut the tubing into ½" lengths—one for each ornament you plan to make—with a 1/16" high-speed steel parting tool [**Photo B**]. Deburr the edges of the tubing with sandpaper.

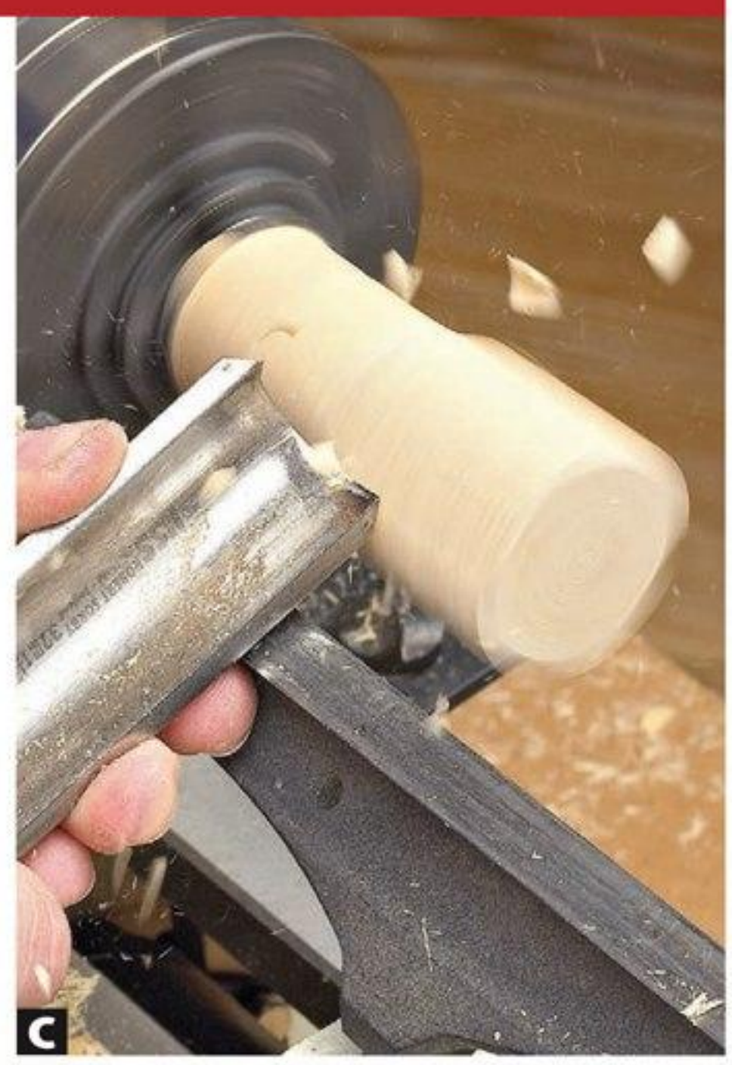


3 Turn a cylinder with a tenon

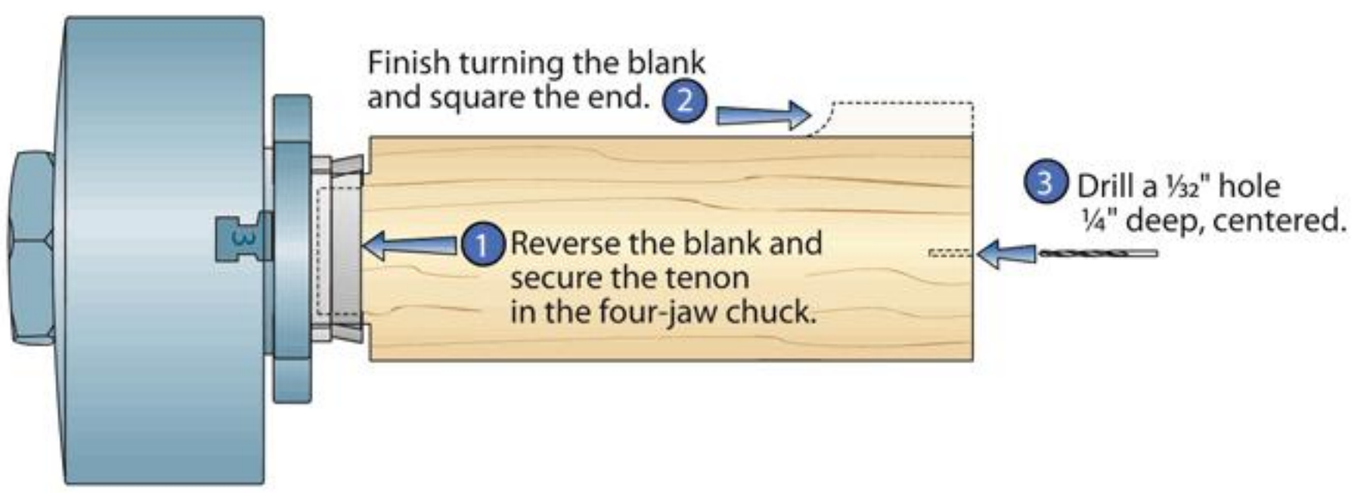
Tools: Spindle roughing gouge, 3/8" parting tool, skew chisel, 1/32" drill bit
Tool rest: Slightly below center
Speed: 2,000 rpm

Reattach the jaw set and mount the bulb blank in the chuck. Use a spindle roughing gouge to turn most of the blank into a 1 5/16" cylinder. ***Note:*** *To avoid catching the turning tool in the four-jaw chuck, never turn closer than 3/8" to the chuck.* Then form a 1" tenon 3/8" long using a 3/8" parting tool.





Now, reverse the blank, gripping the tenon in the four-jaw chuck and finish turning the cylinder [**Photo C**]. Use a skew chisel to square the end and make a small dimple to mark the center. Carefully drill a 1/32" hole 1/4" deep by manually pushing a 1/32" bit into the dimple [**Photo D**].

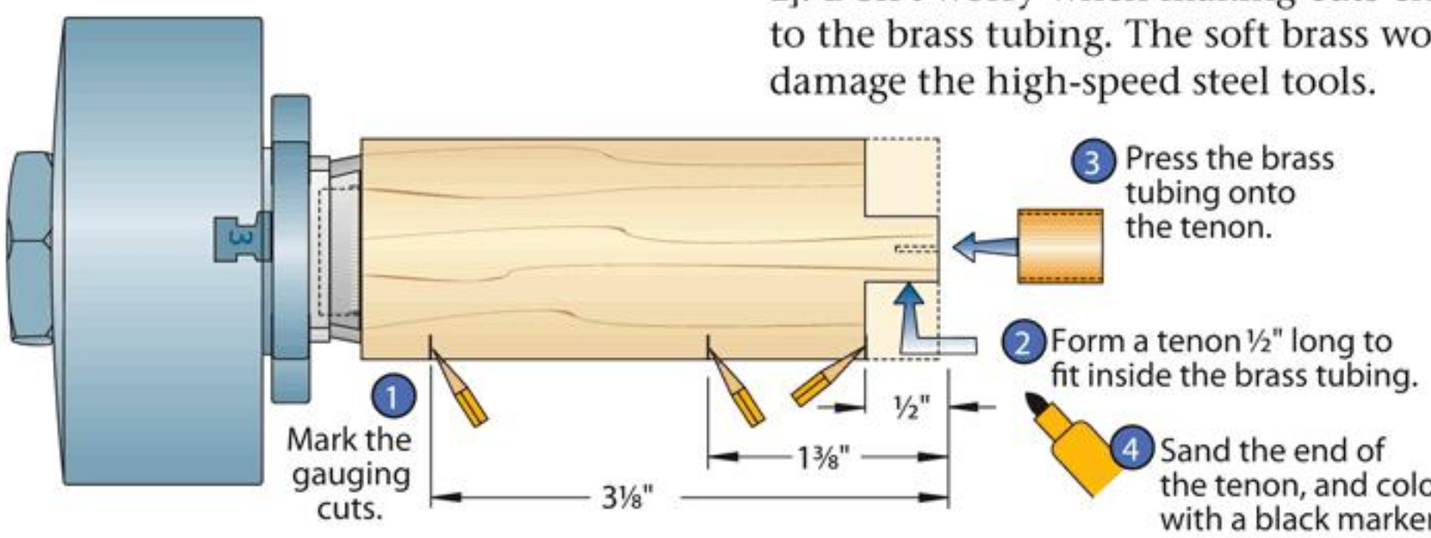

Finish turning the blank and square the end. 2
3 Drill a 1/32" hole 1/4" deep, centered.
1 Reverse the blank and secure the tenon in the four-jaw chuck.

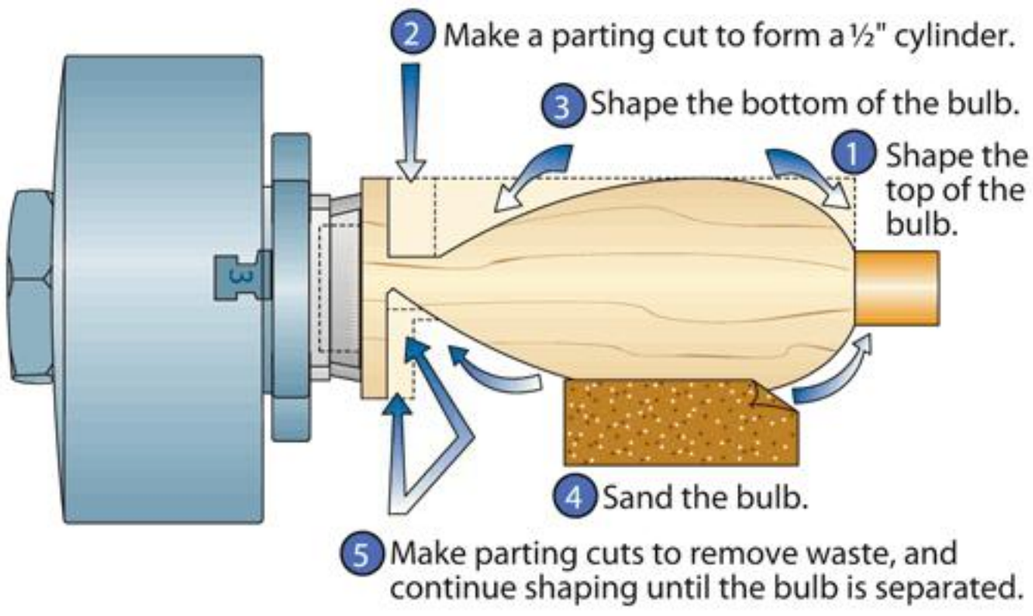
4 Shape the bulb

Tools: Marking gauge, ⅜" parting tool, skew chisel
Tool rest: Parting tool, slightly below center; skew chisel, center
Speed: 2,000 rpm

Create a marking gauge, as shown in the **Shop Tip** *below*, and use it to mark the critical diameters. With the tool rest centered, use a ⅜" parting tool to form a ½"-long tenon on the end, periodically testing the fit of the brass tubing. When the fit is snug, press the brass tubing onto the tenon with a hardwood scrap. Sand the end of the tenon to 320 grit and color the end grain with a black permanent marker.

Center the tool rest and use a skew chisel to shape the top of the bulb [**Photo E**]. Don't worry when making cuts close to the brass tubing. The soft brass won't damage the high-speed steel tools.


3 Press the brass tubing onto the tenon.
2 Form a tenon ½" long to fit inside the brass tubing.
4 Sand the end of the tenon, and color with a black marker.
1 Mark the gauging cuts.
½"
1⅜"
3⅛"


2 Make a parting cut to form a ½" cylinder.
3 Shape the bottom of the bulb.
1 Shape the top of the bulb.
4 Sand the bulb.
5 Make parting cuts to remove waste, and continue shaping until the bulb is separated.

Next, place the tool rest slightly below center to turn a ½"-diameter cylinder at the bottom of the bulb with the parting tool. Then, use the skew chisel to shape the bottom of the bulb to the cylinder, checking your progress with the template.

Finish-sand the bulb. With the skew chisel, make parting cuts to finish shaping until the bulb separates [**Photo F**].

5 The finish really makes this bulb shine

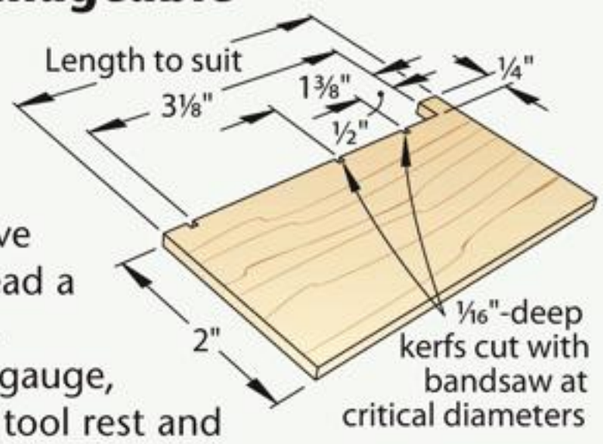
Clean up the tip with a sharp knife and sandpaper [**Photo G**]. Install the brass screw-eye in the hole in the bulb screw base. To color the bulb, dip it into a water-based tinted stain. (We used Minwax Water-Based Wood Stain clear base tinted in Lemongrass, Mandarin Orange, Spice, Green Tea, Antique Red, and Deep Ocean.) Shake; then wipe off the excess. Reapply stain as necessary until you achieve the desired color. Then, apply a clear finish. (We sprayed on three coats of aerosol semigloss lacquer, sanding to 320 grit between coats.)

SHOP TIP

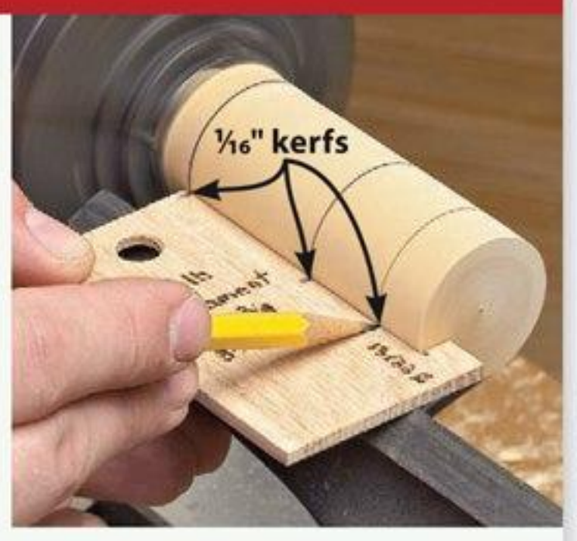
A marking gauge makes multiples manageable

A project as quick, easy, and satisfying as this turned Christmas ornament almost demands that you make multiples. To speed the task of marking the critical diameters, our turning expert, Brian Simmons, created this simple marking gauge.

To make your own, start with a piece of ⅛×2×3⅝" hardwood. Bandsaw a strip from one long edge, leaving a ¼" lip, as shown at *right*. Measure the critical diameters—½", 1⅜", and 3⅛"—from the lip and mark. With your bandsaw, cut a 1/16" kerf at each mark—just enough to give your pencil lead a resting place.



To use the gauge, rest it on the tool rest and against the turning cylinder. Slide the lip until it stops against the end. Then use the bandsaw kerfs as precise, repeatable pencil guides to mark the critical diameters, as shown at *right*.



Written by **Lucas Peters** with **Brian Simmons**
Project Design: **Brian Simmons**
Illustrations: **Roxanne LeMoine**

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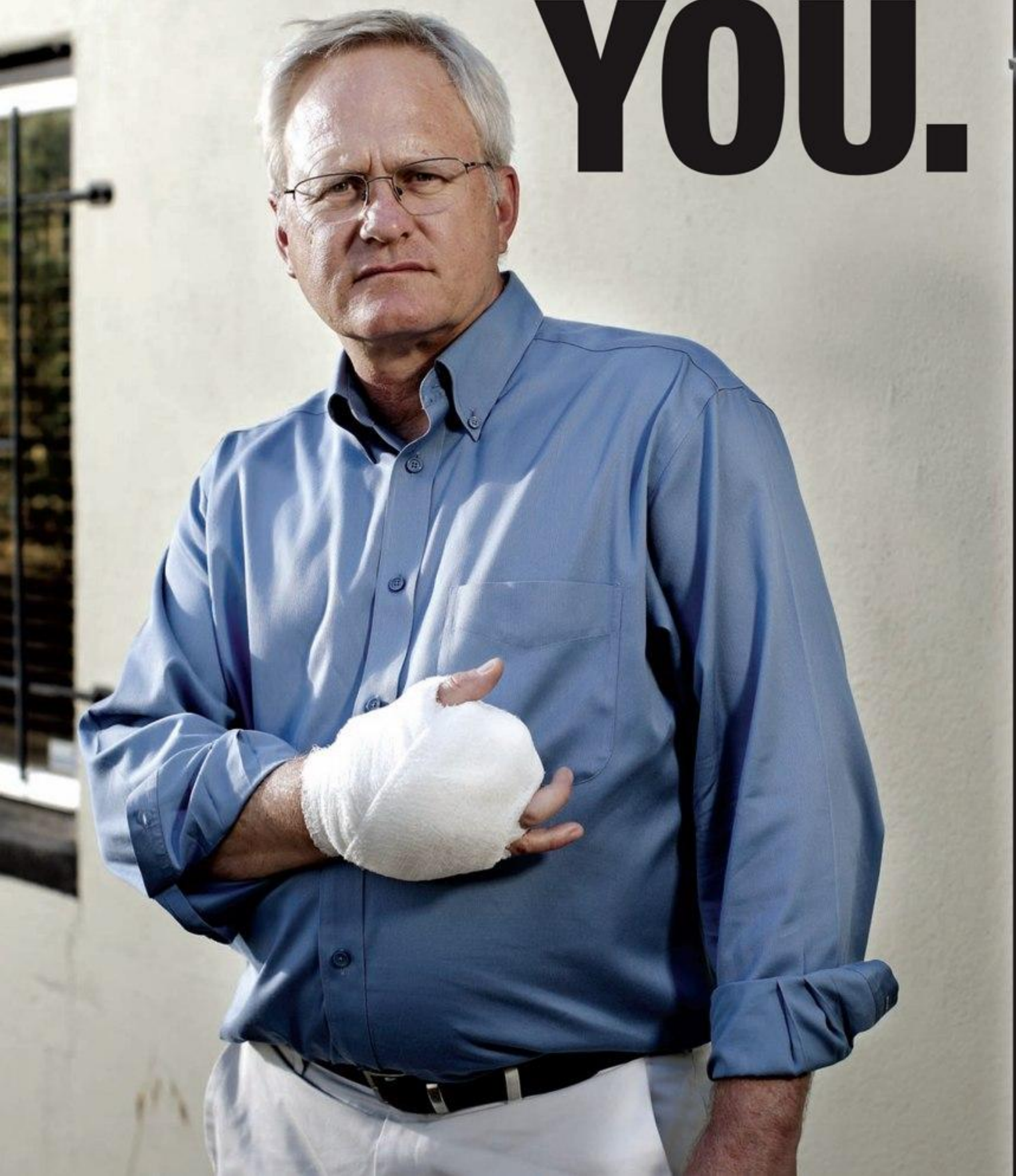

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Step-by-Step

End-Grain Butcher Block

Whether you want a checkerboard or a cutting board, it's easy to create this functional, attractive worksurface.

From the earliest times, when wooden butcher blocks were little more than slabs of tree trunk, end grain provided a superior cutting surface. Why? Because the grain makes for a tough, durable face that self-heals, closing up when cut by a knife.

These days, you can make your own butcher block for projects ranging from cutting boards to countertops with this simple technique. Contrasting woods, such as the cherry and maple shown *above*, add an extra element of pizzazz. But if you prefer a classic look, stick with a single species.

Start by blocking it out

To plan a butcher block, first divide the length and width of the final project by the number of blocks you want in each direction. You'll need extra-thick stock to make blocks more than ¾" square.

For the 10×10" cutting board shown, we wanted eight rows of squares along its width and length. Dividing each 10" dimension by 8 means each block in the finished butcher block would measure 1¼" square.

With those final dimensions in hand, you'll want to leave yourself a little extra thickness for final machining before you start the glue-up. So, we started with 1½"-thick stock.

Now it's time to rip strips

To ensure a precise fit of the parts and avoid wood movement problems, cut, joint, and plane all strips at the same time. Begin by ripping the strips about 1/16" wider than their final widths. Joint the freshly ripped face and mark it with an S for "side." With the S face down, plane each strip to final width. (Ours was 1¼".) Now, joint an adjacent face of each strip [**Photo A**] and mark it with a D, for "down." With the D face down, plane

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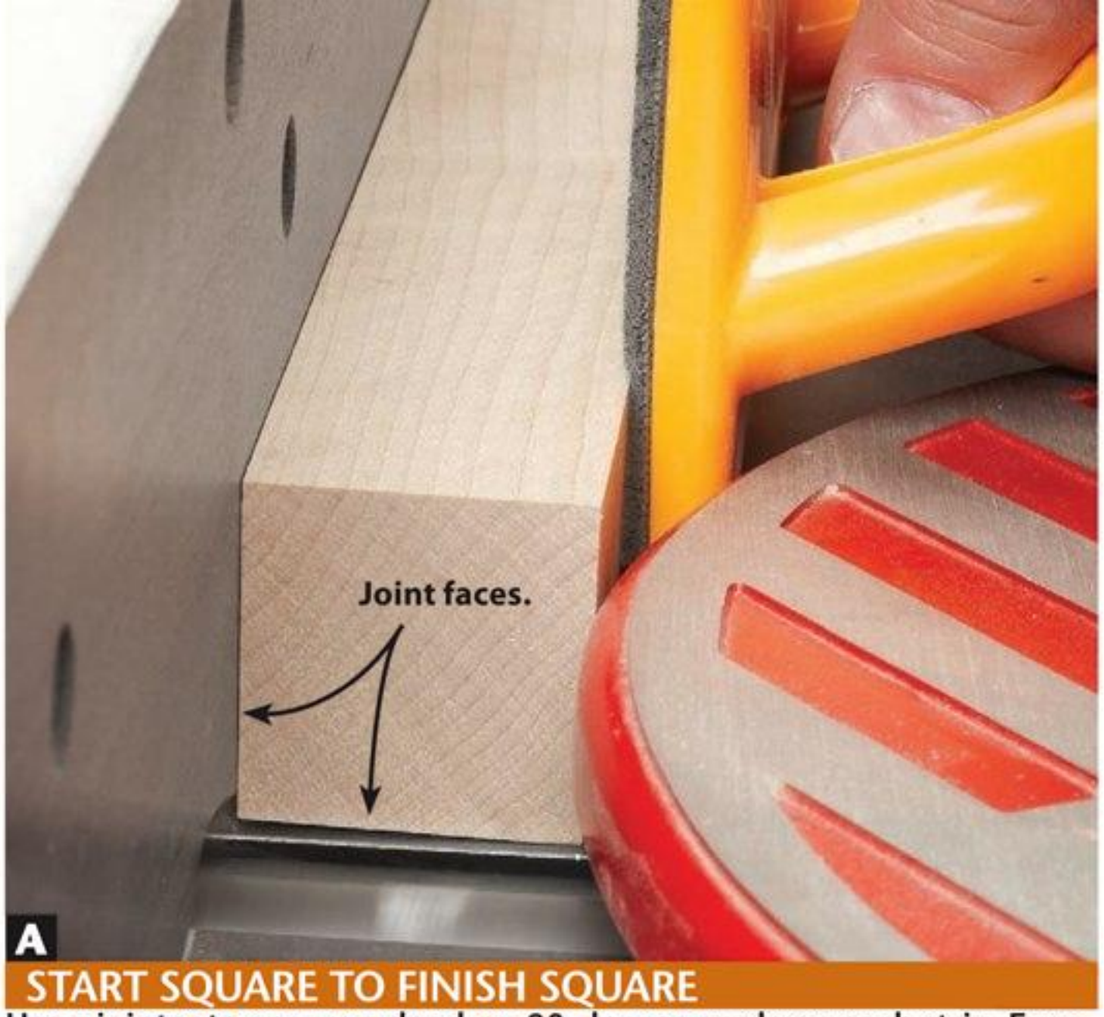


A

START SQUARE TO FINISH SQUARE

Use a jointer to ensure a dead-on 90-degree angle on each strip. Even a minute angular error multiplies in a butcher block.

B

STRIPS BECOME A BLOCK BLANK

For a striped or checkerboard cutting board, alternate strips of different species before gluing them together into a blank.

C

CUT THE BLANK INTO BLOCKS

You could use a crosscut sled for this cut, but the 12" width and short length of the blank make it safe to crosscut using your rip fence.

D

HERE'S HOW THEY END UP

Lay out the strips as they will appear in the final project. For our checkerboard pattern, we also flipped every other strip end for end.

the strips oversize by ⅛" (bringing our 1½"-thick stock to 1⅜").

Before gluing, ready your clamps and dry-assemble, orienting the D faces down and the S faces to the side. If your butcher block consists of a lot of strips, break the job into subassemblies small enough to handle comfortably. Allow the glue to dry, and then glue the subassemblies together.

To keep the pieces from shifting as they're clamped, tighten one clamp just enough to draw the pieces together. Feel the joints and squeeze the pieces flush before lightly tightening the next clamp. Tighten the clamps in turns for even pressure [**Photo B**].

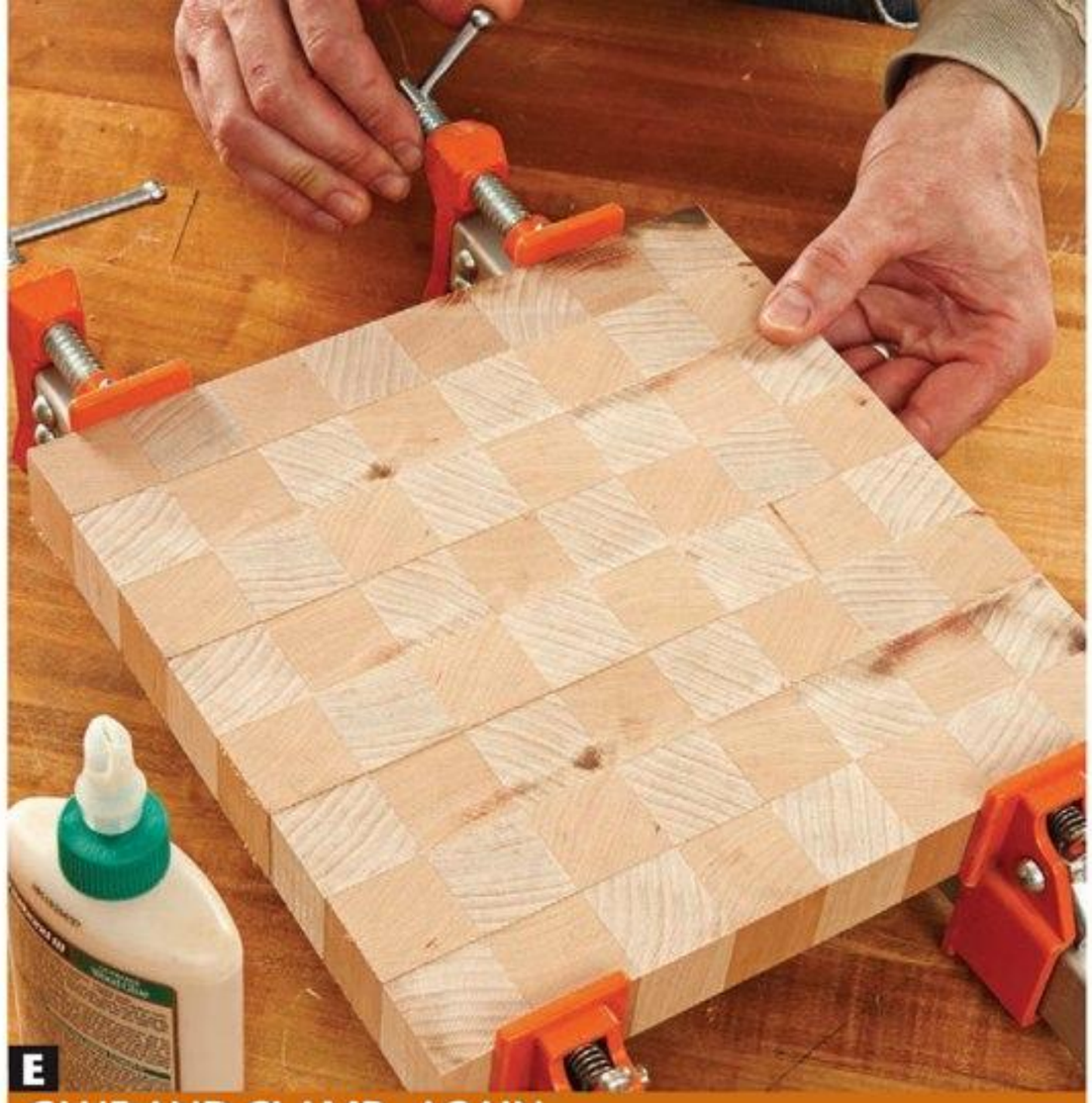
After the glue dries, scrape off any squeeze-out and plane the blank to the final thickness. Then, trim one end of the blank square using a miter gauge, or crosscut sled on your tablesaw.

Crosscut, flip, repeat

Any chipping or tear-out at this point will show in your final project, so install a sharp crosscut blade in your tablesaw. Crosscut the blank into strips about ⅛" wider than the final butcher block thickness [**Photo C**] to allow for final sanding. To avoid making deep, hard-to-sand-out scorch marks, feed the blank through the blade without stopping.

Quick Tip! Begin the next glue-up immediately. Cutting the blank releases tension in the wood, which can cause the new strips to warp. So after cutting these strips, move directly to the second glue-up.

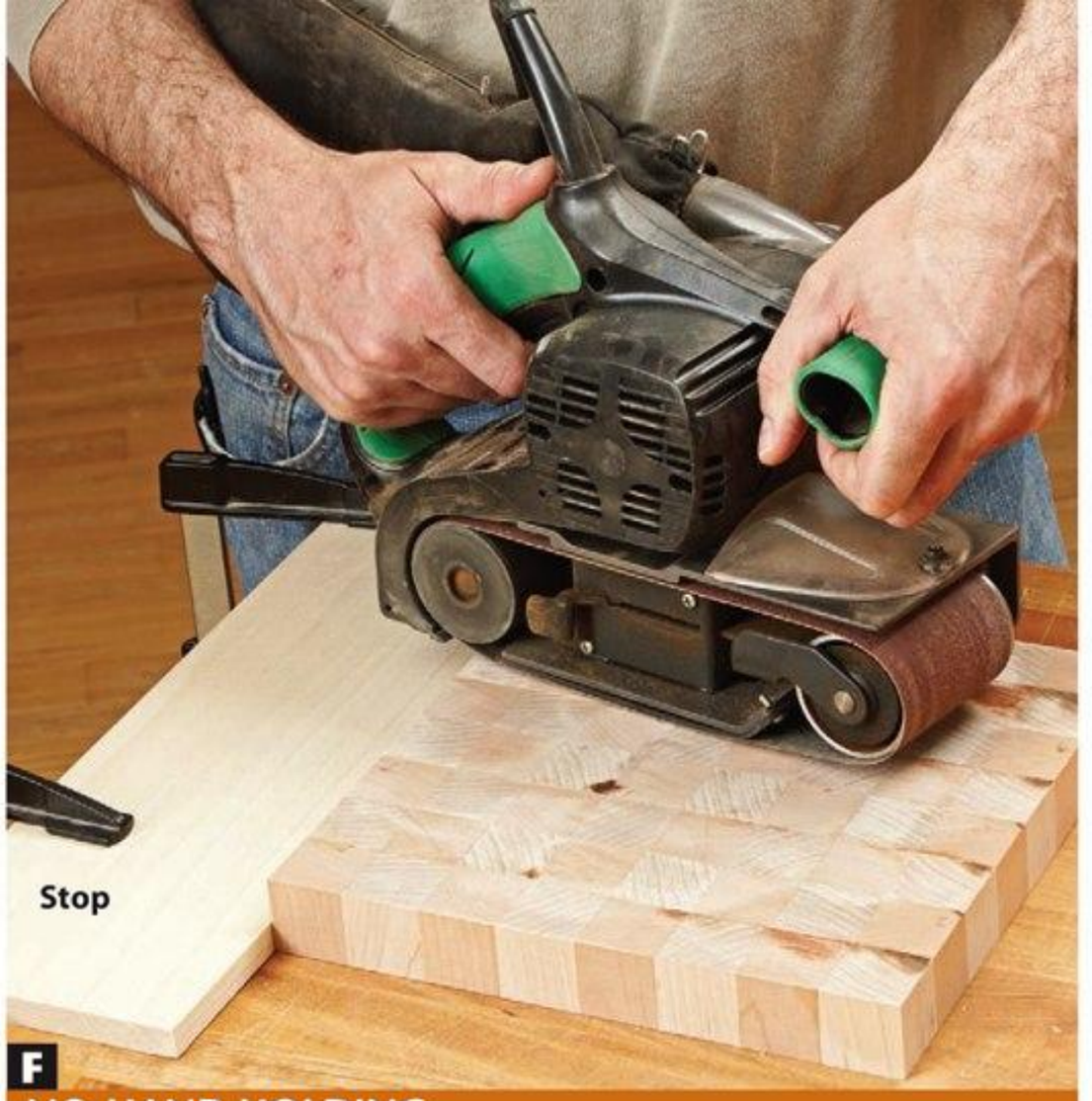
Keep the strips in the same order they come off the blank as you turn them end-grain-up [**Photo D**]. To create a checkerboard, also flip alternating strips end for end. Now, reglue these together into a butcher block [**Photo E**].



E

GLUE AND CLAMP...AGAIN

While gradually tightening the clamps, feel each joint to make sure the strips align flush on the top or bottom to minimize cleanup.



F

NO-HAND HOLDING

Clamp a scrapwood stop to your workbench and use the force of the belt sander to keep the workpiece in place while you sand.

After the glue dries, remove burn marks, glue smears, unevenness, and end-grain roughness from both sides using a belt sander with 60- or 80-grit abrasive **[Photo F]**. Sand the entire surface equally and keep the belt sander moving to avoid depressions in the cutting-board face.

Safety note: *To avoid severe tear-out and possible planer damage, never run an end-grain glue-up through your planer.*

Check each face with a straightedge and sand down any high spots you find. After you flatten both sides, rout a ¼" round-over on all of the edges. Then, finish-sand up to 220 grit with a random-orbit sander.

Apply mineral oil. (See the **Shop Tip** at *right* for a food-safe finish.) Or, if you're more interested in checkers than chopping, apply three coats of a durable film finish, such as polyurethane.

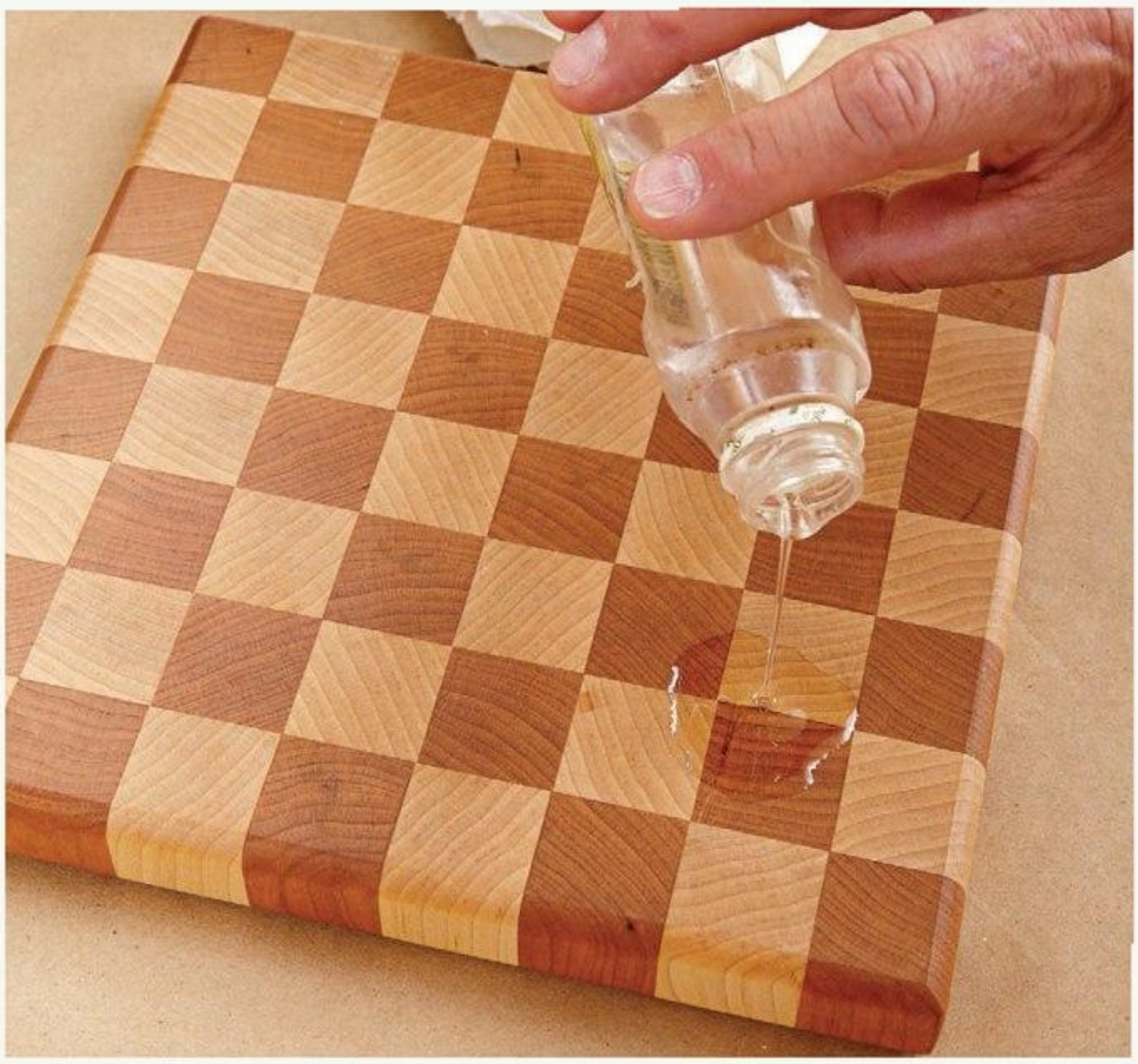
Written by **Bob Wilson** with **Kevin Boyle**
Illustrations: **Roxanne LeMoine**; **Lorna Johnson**

SHOP TIP

Create a food-safe surface

Tight-grained hardwoods, such as maple, cherry, and walnut, make excellent cutting boards because their tight end-grain pores don't readily absorb water or meat juices.

To finish a cutting board, saturate it with mineral oil and allow the oil to penetrate for 5 minutes before wiping off the excess. Reapply when the surface looks dry.



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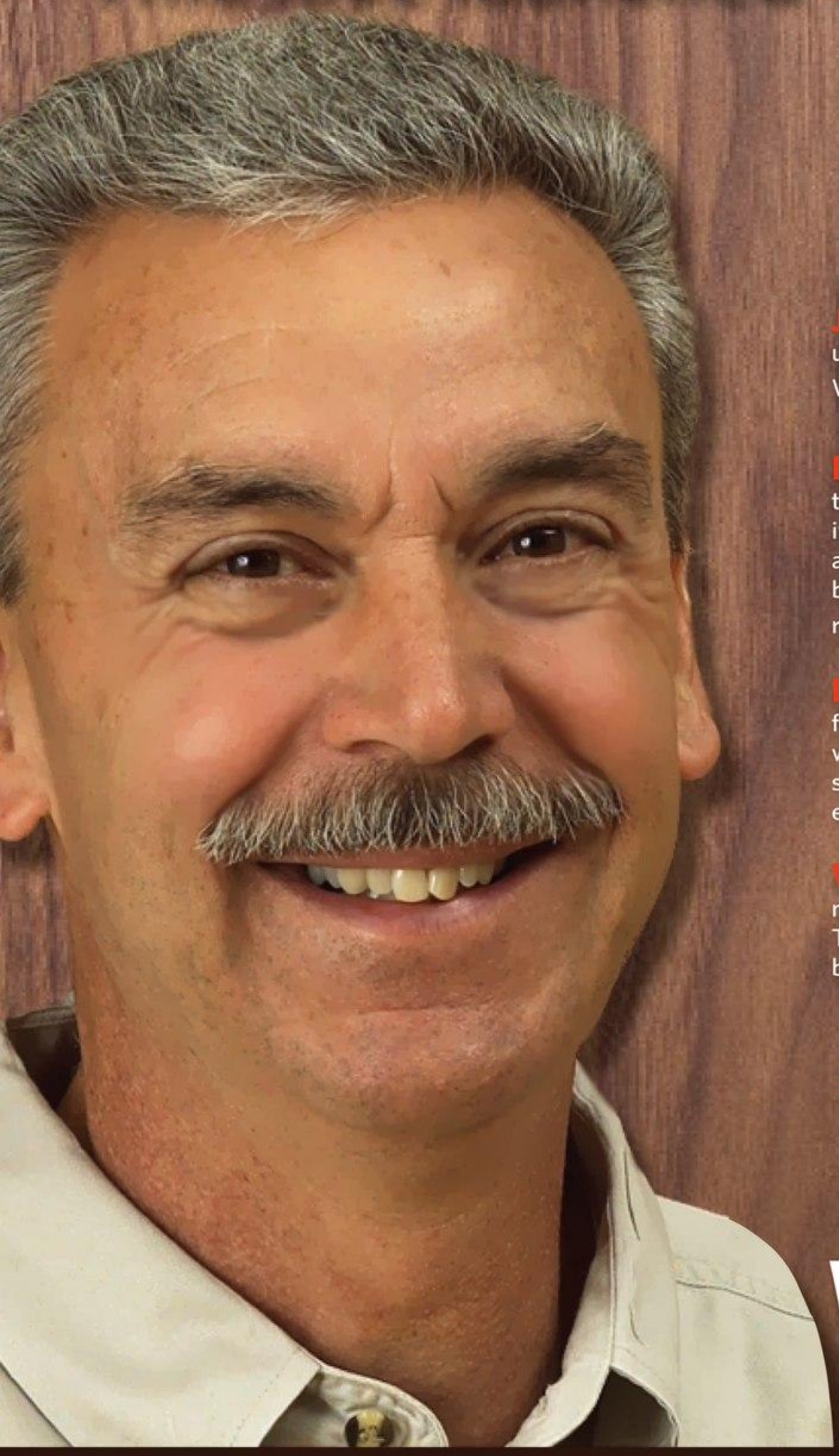
This face launched 1,000 projects.



JIM HEAVEY is WOOD Magazine's Contributing Craftsman and a popular educator at The Woodworking Shows.

Favorite Tool: Most woodworkers will say that the table saw is their favorite but, because of its almost limitless versatility, I count my router as one of my top favorites. The more you use and become familiar with it, the more apt you are to reach for it. You'll see more at this season's shows.

Best Project: Bedroom sets that I have made for my children after they celebrate their first wedding anniversaries. I enjoy knowing that something I've made is playing a part in their lives every day.

Working On: Remodeling the lower level of my home. Part of this work will be an "Irish Pub". The project has gotten delayed a couple of times but this time for sure!

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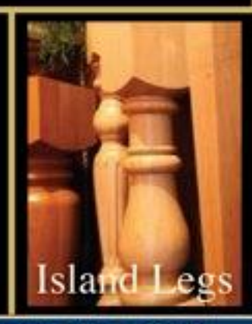
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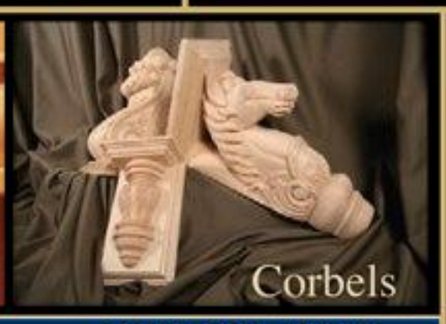
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Colt bits generate unbridled boring enthusiasm

I've tried a lot of drill bits in my nearly six decades as a woodworker, with varying degrees of success. These German-made, high-speed-steel Colt drill bits are the finest I've used.

For example, I used a 1½" MaxiCut Forstner bit to bore 100 holes ½" deep in hard maple, and the bit not only cut clean, accurate holes, but it also stayed cooler than other Forstner bits put to the same test. I like the way the unique, stepped teeth on the chip-breakers slice off narrow shavings that don't clog up my shop vacuum the way the large spiral shavings from other Forstner bits tend to do.

Each of the MaxiCut Forstner bits features two shallow flats on its shank, and because of that I couldn't make them slip in a drill chuck no matter how hard I tried. These flats work with the RotaStop 5" Morse-taper adapter and 8" extension to bore deep holes using your drill press or lathe. I used this setup with a 35mm bit to bore the 10" length of a 38mm-square hard maple blank. It never wavered side-to-side nor burned the wood. Impressive.

I found Colt's Five Star brad-point bits and steep-fluted PenBlank pen-drilling bits to be exceptional. Both bored clean, precise holes without tear-out in all materials and cleared chips without having to repeatedly back the bits out of the wood.

The brad-point bits sell individually and in Imperial and metric sets of seven. The pen bits come individually and in 5-packs. The MaxiCut Forstner bits come in 20 Imperial sizes and 24 metric, individually or in sets of five and 10.

—Tested by Dean Fiene, a WOOD® *magazine tool tester for 10 years*

Colt drill bits

Performance		★★★★★
Price	MaxiCut Forstner bits	$25–$45 each
	MaxiCut Forstner bit sets	$125–$325
	RotaStop Extension	$25–$35
	RotaStop Morse Taper adapter	$42
	Five Star 7-pc. brad-point sets	$70
	PenBlank 5-pc. pen-drilling set	$70

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One-handed mini-plunge router proves handy

I wasn't sure how much I'd use a small plunge router, but after running Trend's T4 through the paces on several projects I find myself reaching for it more and more. Essentially a trim router in a plunge base, the T4 works great for inlays and other light-duty plunge work. Because it weighs just over 5 lbs, it's more nimble than my midsize plunge routers. And when you want to rout against a straightedge, the base has two parallel flat edges, as well as the guide fence that mounts on either side. I used the T4 to rout mortises freehand for the backs of chairs, and it performed flawlessly without trying to stray from my layout marks.

I only have two knocks against this handy router. First, the scales are metric. Second, the depth stop rod would not stay tight unless I turned the locking knob a half-turn, which hid the scale (that I wasn't using anyway).

The T4 comes with ¼", 6mm, and 8mm collets, a ⅝" guide bushing, an adapter for Porter-Cable-style bushings, and a guide fence. The variable-speed motor ranges from 11,500 to 32,000 rpm.

—Tested by Matt Seiler, a custom furnituremaker

Plunge router, #T4

Performance	★★★★☆
Price	$155

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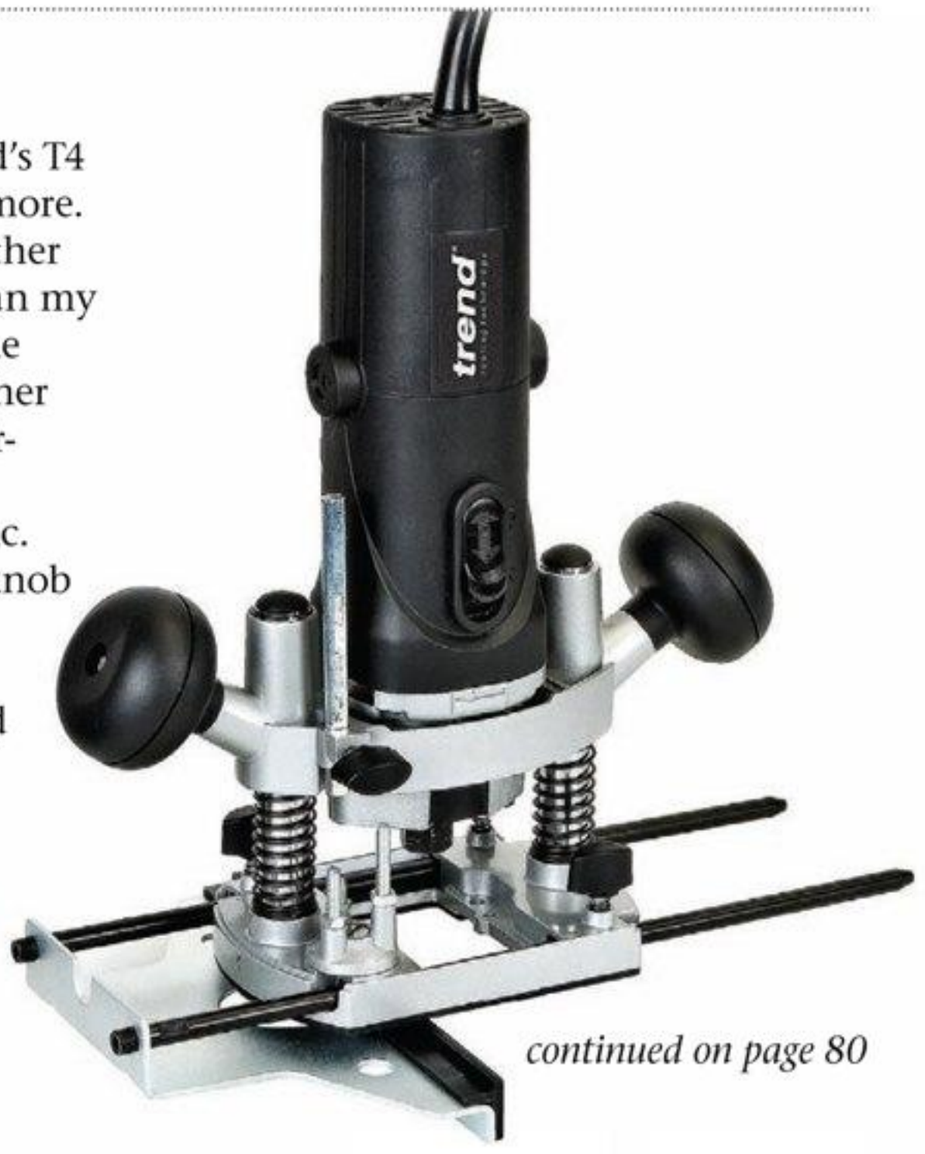

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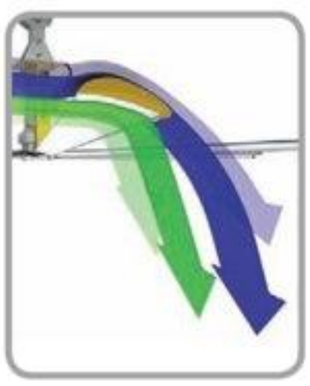

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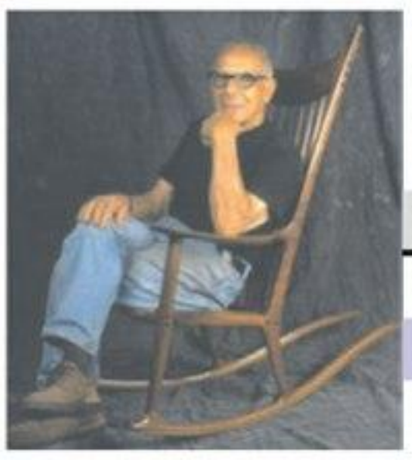

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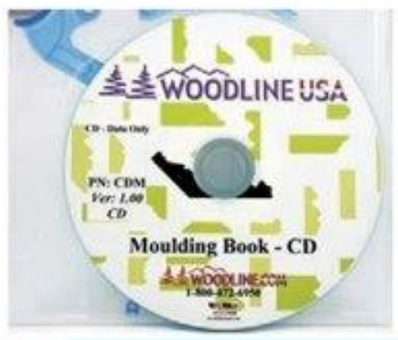

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Gimmicky features detract from this bandsaw's abilities

General International might have packed too many features into this 15" bandsaw: Some work fine, others don't. It's a smooth-running, powerful bandsaw with nice workpiece capacities (up to 12" for resawing and 14¾" width), but too often the features become gimmicks. For instance, the top half of the saw moves up and down on a 5" steel shaft, allowing you to use any size blades from 93½" to 106". But the 90-200 M1 cut just as accurately without flexing at its maximum height as it did in the lowest setting, so I don't really see the benefit of returning to the low setting.

I like the extruded aluminum rip fence because it can be used standing at 4⅜" tall, as shown, or lying flat just ⅝" tall, where it doesn't bump into the blade guides when sawing thin workpieces. The rack-and-pinion table works well, tilting as much as 45° to the right. But the bearing blade guides proved difficult to adjust and set accurately. And the battery-powered laser is blocked by the blade guard unless set 1¾" above the cutline.

—Tested by Doug Hicks, a former shop teacher and woodworking magazine editor

15" Adjustable-Height Bandsaw, #90-200 M1

Performance	★★★☆☆
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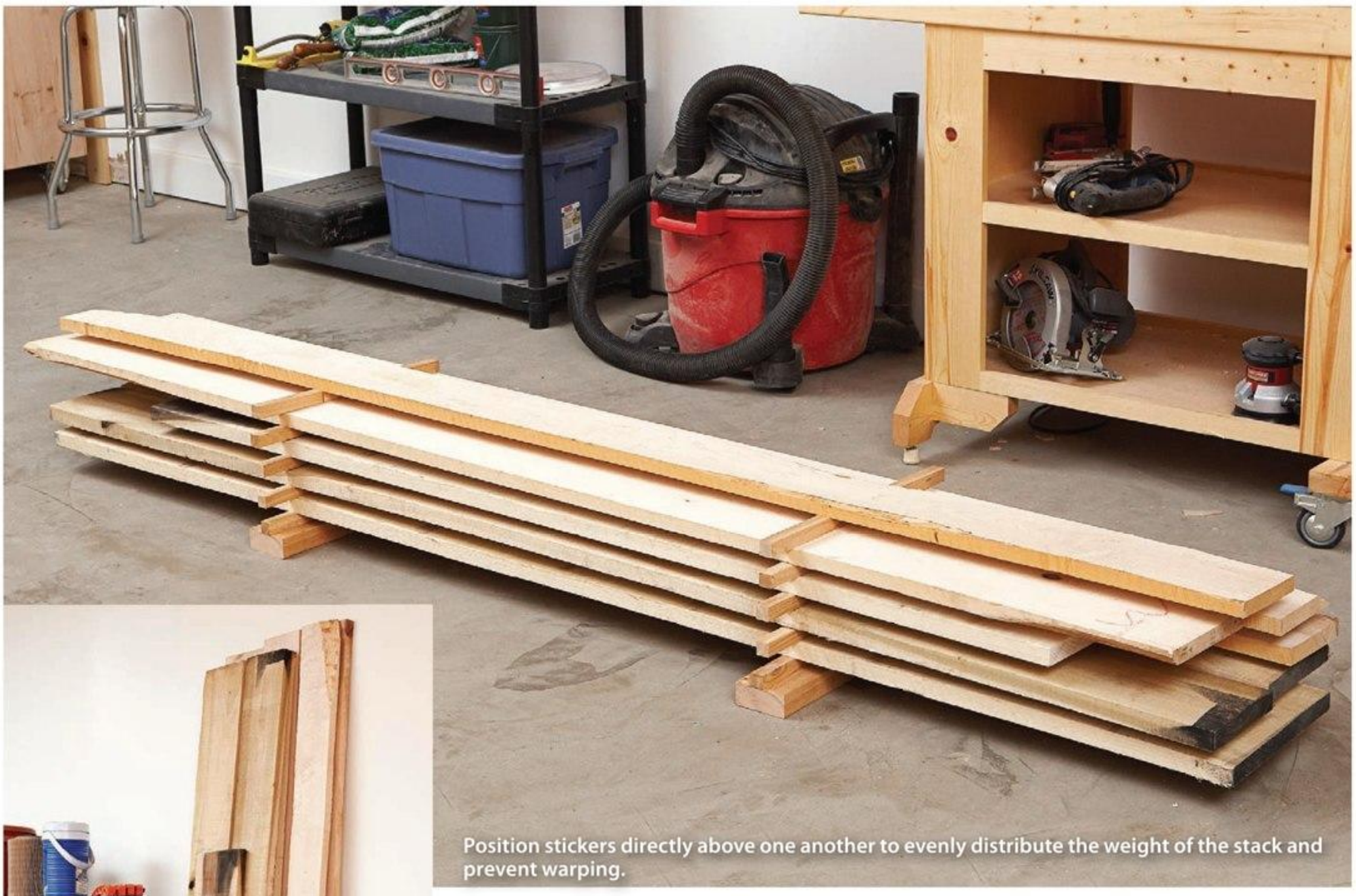
For an answer to your woodworking question, write to **ASK WOOD, 1716 Locust St., LS-221, Des Moines, IA 50309-3023** or e-mail us at **askwood@woodmagazine.com**. For immediate feedback from your fellow woodworkers, post your questions on one of our woodworking forums at **woodmagazine.com/forums**.



Position stickers directly above one another to evenly distribute the weight of the stack and prevent warping.

Prop the vertical wood as straight up-and-down as possible while leaving gaps at the bottom for air circulation.

Wood storage: Stack it or stand it?

Q: I'm doing a huge shop overhaul and considering all my organization options. So the question arose: Should hardwood be stored horizontally or vertically?

—James Litten, Goldsboro, N.C.

A: Good news, James. Either way is okay as long as you keep a few things in mind.

Wood newly arrived in your shop should acclimate even if it's kiln-dried. So if you're stacking it horizontally, sticker the lumber for the first few weeks. Stickers—strips of ¾×¾" wood stacked crossways between layers of lumber, as shown *above*—allow air to circulate evenly around all sides of every piece of wood.

Don't stack the wood directly on the concrete floor. Concrete is porous and—even when it looks dry—wicks moisture from the ground below into the wood. This compounds problems caused by the lack of airflow that direct-floor contact creates.

Standing boards on end introduces a bowing risk in the long-term, but it's a good solution for wood you'll use soon after acclimation. Lean the boards against a wall as vertically as possible, as shown and described at *left*.

continued on page 84

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Brazil Expedition Uncovers Thousands of Carats of Exquisite Natural Emeralds

Brandish a whopping 50 carats of genuine South American emeralds in a handcrafted new necklace design for less than $200.....

and get a $100 Stauer Gift Coupon!

Halfway into our ambitious trek through the rain forest I had to remind myself that "Nothing good comes easy." These days it seems that every business trip to Brazil includes a sweltering hike through overgrown jungles, around cascading waterfalls and down steep rock cliffs. But our gem broker insisted it was worth the trouble. To tell you the truth, for the dazzling emeralds he delivered, I'd gladly go back to stomping through jaguar country.

Now our good fortune is your great reward. Don't miss this rare opportunity to own an impressive 50 carat strand of genuine South American emeralds for under $200. And for a limited time, we'll sweeten every necklace order with **a $100 Stauer Gift Coupon!**

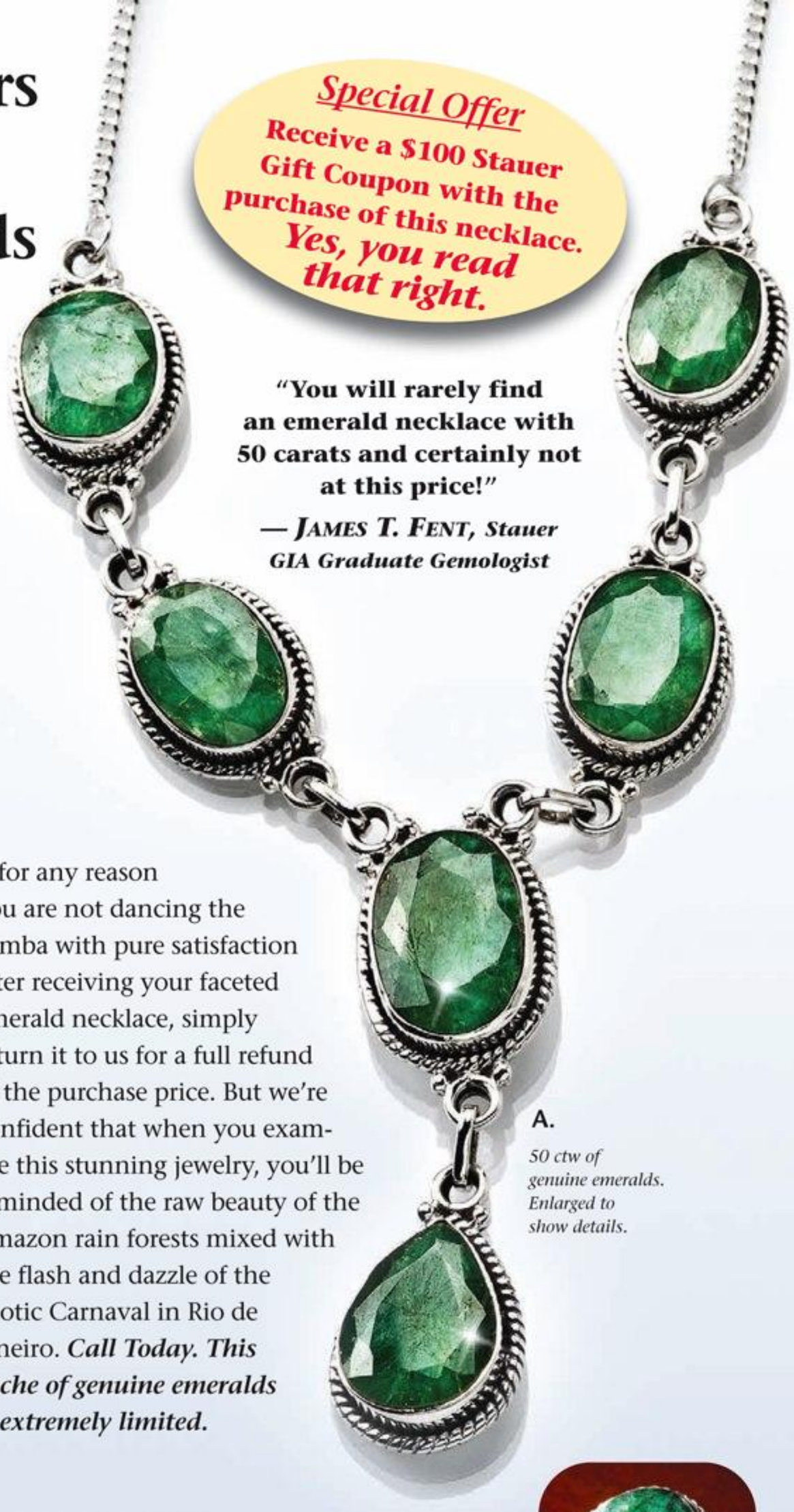
Faced with this embarrassment of riches, our designer transformed this spectacular cache of large stones (each is over 8 carats average weight) into a stunning 50 ctw necklace of faceted emeralds set into .925 sterling silver. Each emerald is surrounded by delicate sterling silver rope work and filigree in the Bali-style. The 18" necklace dangles from a sterling silver chain that fastens with a secure double-sided shepherd's hook clasp.

What is the source of our emerald's timeless appeal?

The enchanting color of the Stauer ***Carnaval*** **Faceted Emerald Necklace** comes from nature's chemistry. Our polished and faceted, well-formed natural emeralds are immediately recognized as something special. Indeed, when we evaluated these emeralds, color was the most important quality factor. Today, scientists tell us that the human eye is more sensitive to the color green than to any other. Perhaps that is why green is so soothing to the eye, and why the color green complements every other color in your wardrobe.

Emeralds are, by weight, the most valuable gemstone in the world.

Now you can wear genuine emeralds and feel great about knowing that you were able to treat yourself to precious gems without paying a precious price. A 100+ carat emerald necklace found on Rodeo Drive or 5th Avenue could cost well over $250,000...but not from Stauer. Wear and admire the exquisite Stauer ***Carnaval*** **Faceted Emerald Necklace** for 30 days.



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— *James T. Fent, Stauer*
GIA Graduate Gemologist

If for any reason you are not dancing the Samba with pure satisfaction after receiving your faceted emerald necklace, simply return it to us for a full refund of the purchase price. But we're confident that when you examine this stunning jewelry, you'll be reminded of the raw beauty of the Amazon rain forests mixed with the flash and dazzle of the exotic Carnaval in Rio de Janeiro. ***Call Today. This cache of genuine emeralds is extremely limited.***

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Ask WOOD

WOOD® editors sign off

Q: How can I creatively but discreetly sign my wood-working projects?

—William Lewis, Philadelphia

A: Attaboy, William! Take pride in—and credit for—the hard work you put into that project. Here are a few ways that *WOOD* Magazine editors mark their projects.

Editor-in-Chief Bill Krier burns his name into the back or bottom of the workpiece with a custom, heated branding iron.

Projects editor Craig Ruegsegger signs and dates his projects in an inconspicuous spot with a felt-tip permanent marker before applying the final coat of finish.

Deputy editor Dave Campbell forgoes a signature, opting to epoxy a newly minted penny in a shallow Forstner-bit hole.

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TODAY - The United States Rare Coin & Bullion Reserve has scheduled the final release of U.S. Gov't Issued $5 Gold Coins previously held at the U.S. Mint at West Point. Please be advised: These Gov't Issued Gold Coins are being released on a first-come, first-serve basis and our U.S. Gov't Gold inventory priced at $139.26 per coin could very possibly sell out! Call immediately to avoid disappointment. This "at-cost" Gov't Gold offer could be cancelled at any time. Do not delay. Call a Sr. Gold Specialist today.

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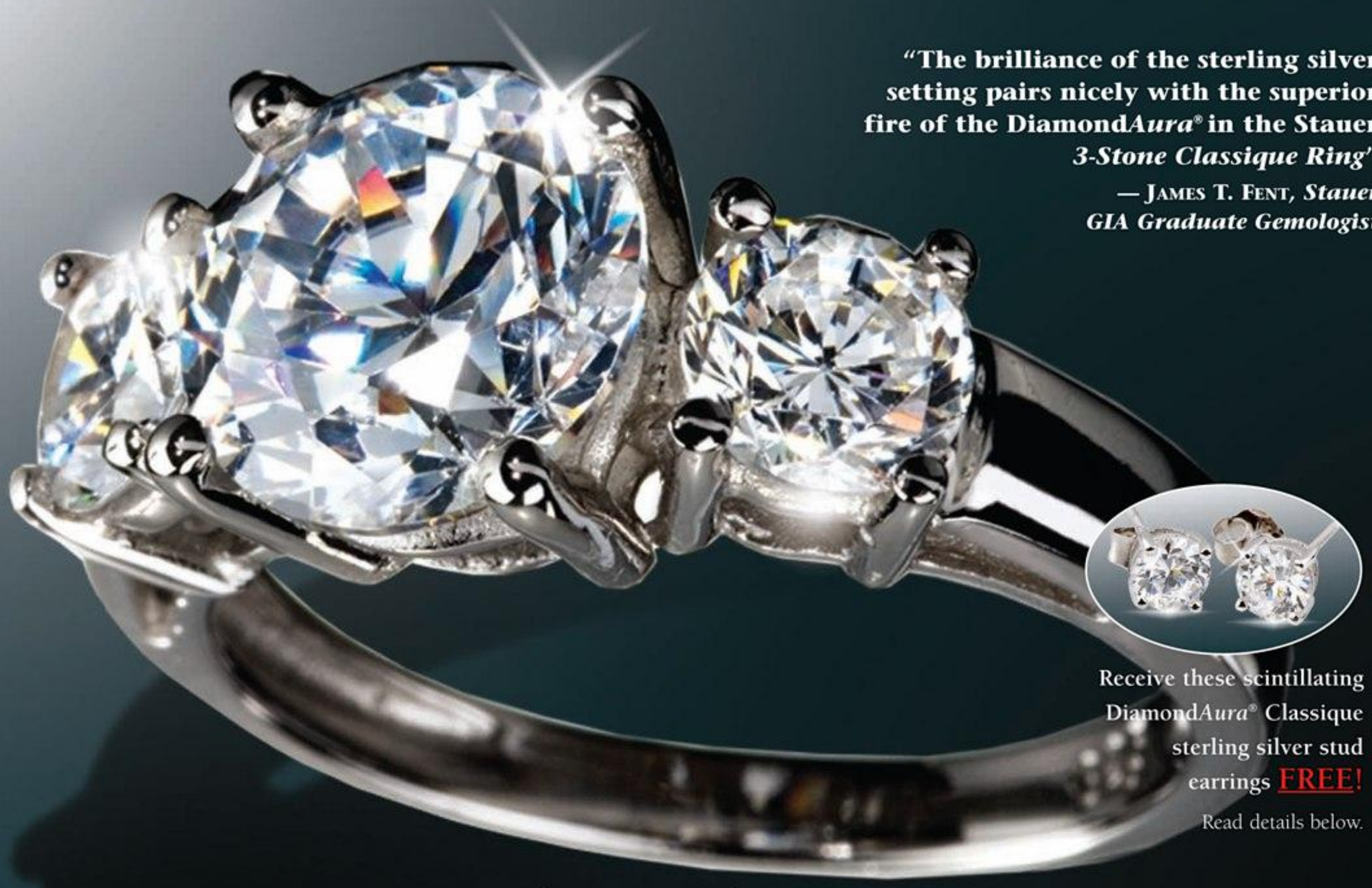

"The brilliance of the sterling silver setting pairs nicely with the superior fire of the Diamond*Aura*® in the Stauer *3-Stone Classique Ring*"

— James T. Fent, *Stauer GIA Graduate Gemologist*

Receive these scintillating Diamond*Aura*® Classique sterling silver stud earrings FREE!

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The Fifth C?

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Perfection from the laboratory. We named our brilliant cut stones Diamond*Aura*, because, "they dazzle just like natural diamonds but without the outrageous cost." We will not bore you with the incredible details of the scientific process, but will only say that it involves the use of rare minerals heated to an incredibly high temperature of nearly 5000˚F. This can only be accomplished inside some very modern and expensive laboratory equipment. After several additional steps, scientists finally created a clear marvel that looks even better than the vast majority of mined diamonds. According to the book *Jewelry and Gems–the Buying Guide*, the technique used in Diamond*Aura* offers, ***"The best diamond simulation to date, and even some jewelers have mistaken these stones for mined diamonds."***

Compare For Yourself at 2 ½ carats		
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Color	"D" Colorless	"D" Colorless
Clarity	"IF"	Clear
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2 ½ c.t.w. ring	$60,000+	$145

The 4 C's. Our Diamond*Aura* 3-Stone Classique Ring retains every jeweler's specification: color, clarity, cut, and carat weight. The transparent color and clarity of Diamond*Aura* emulate the most perfect diamonds—D Flawless, and both are so hard they will cut glass. The brilliant cut maximizes the fire and radiance of the stone so that the light disperses into an exquisite rainbow of colors.

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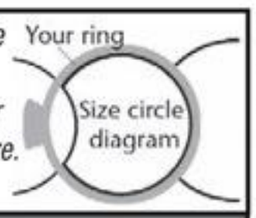
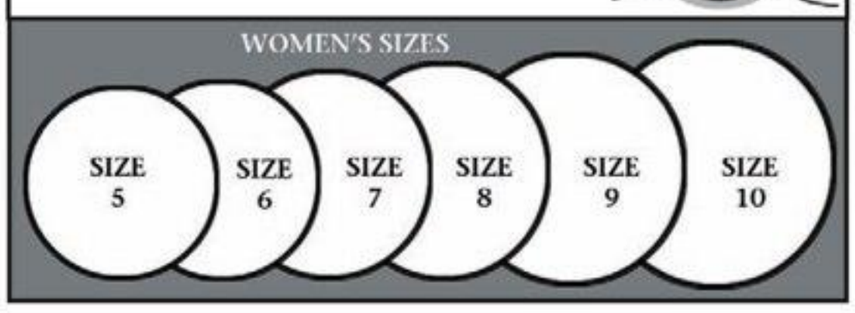
Place one of your own rings on top of one of the circle diagrams. Your ring size is the circle that matches the inside diameter of your ring. If your ring falls between sizes, order the next larger size.





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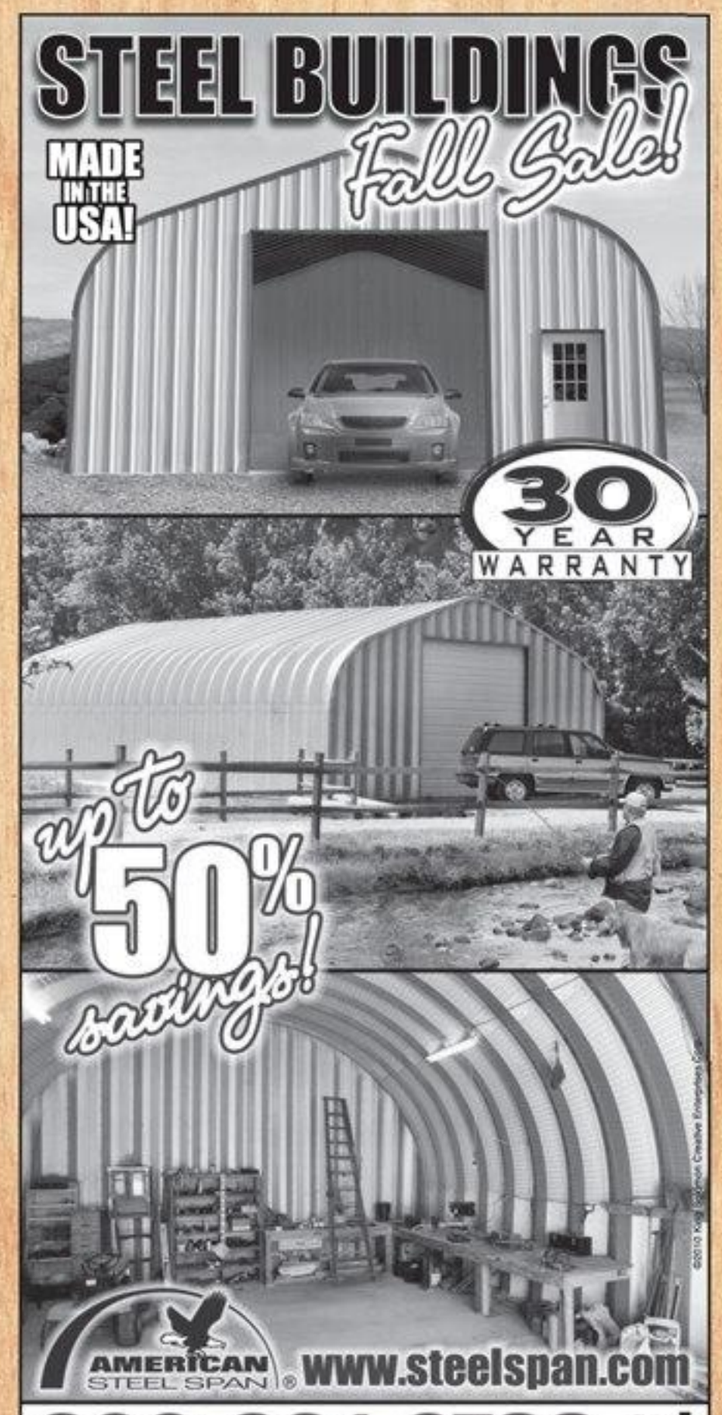

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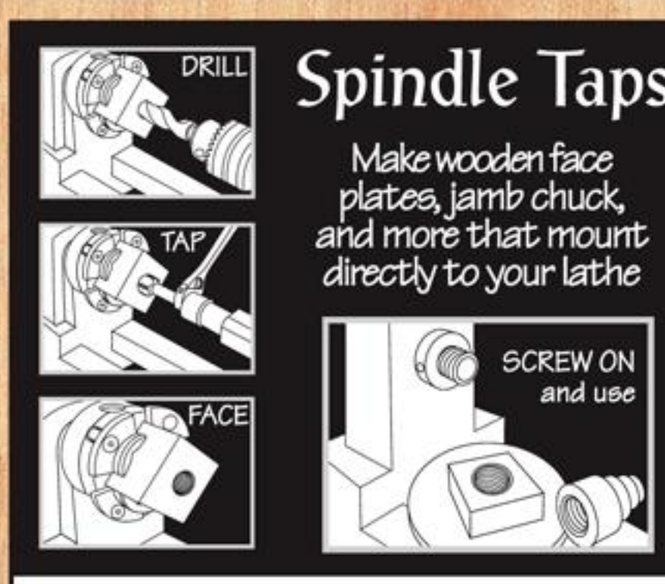

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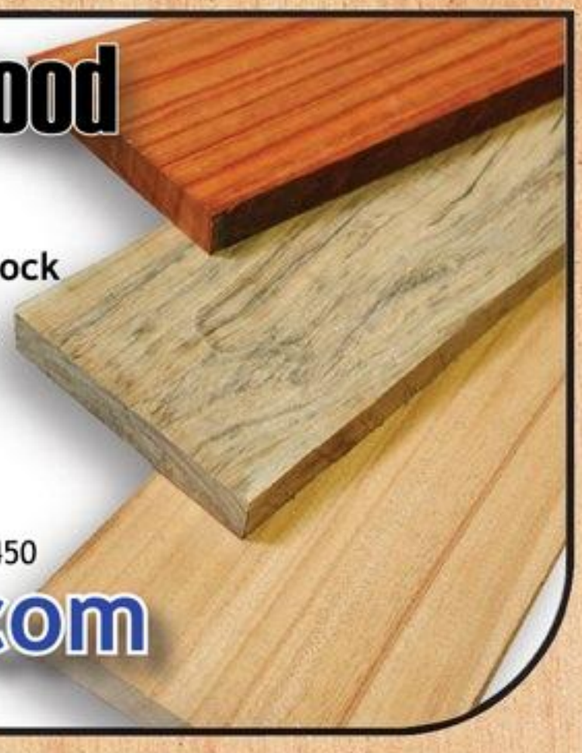

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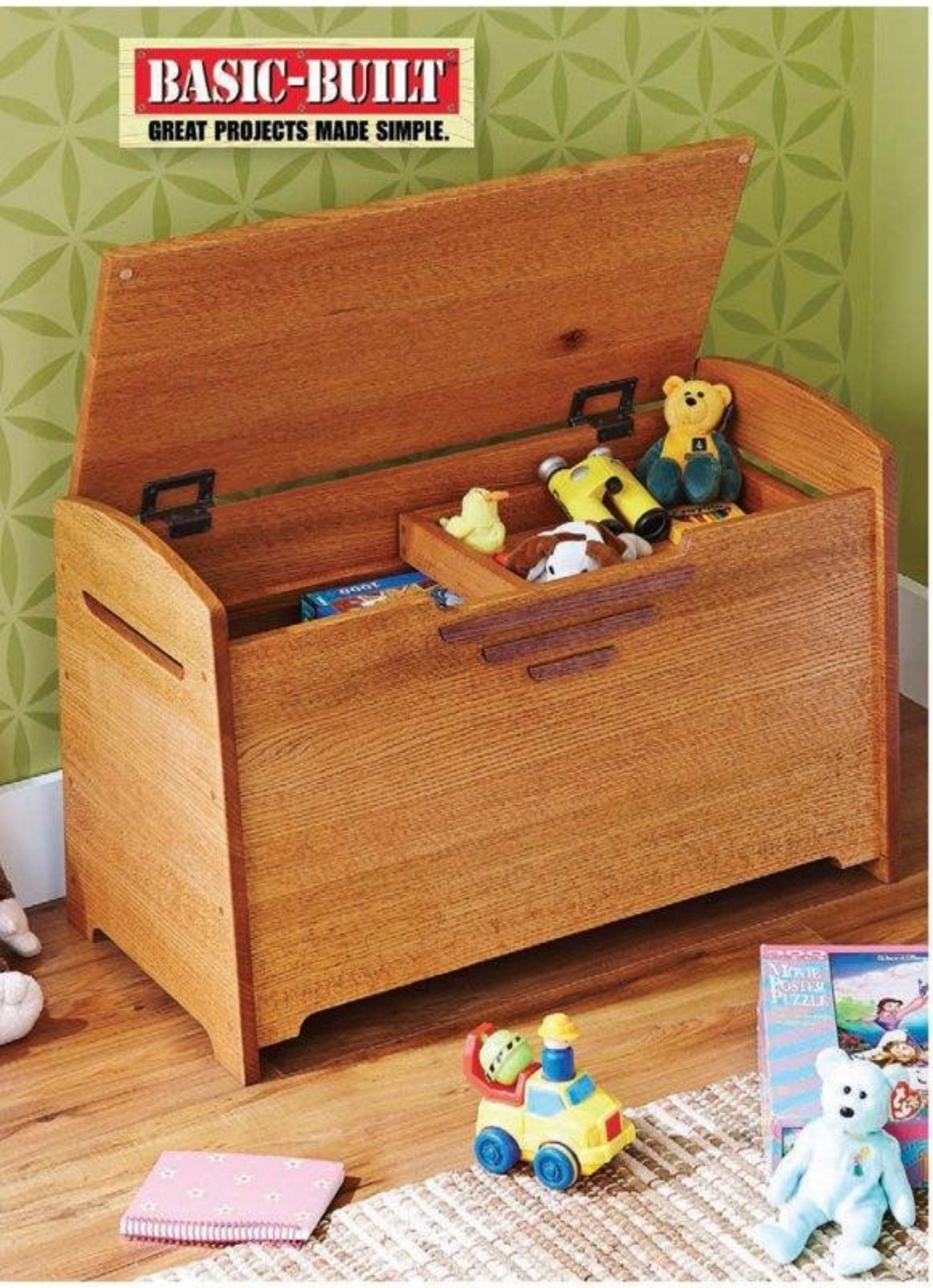
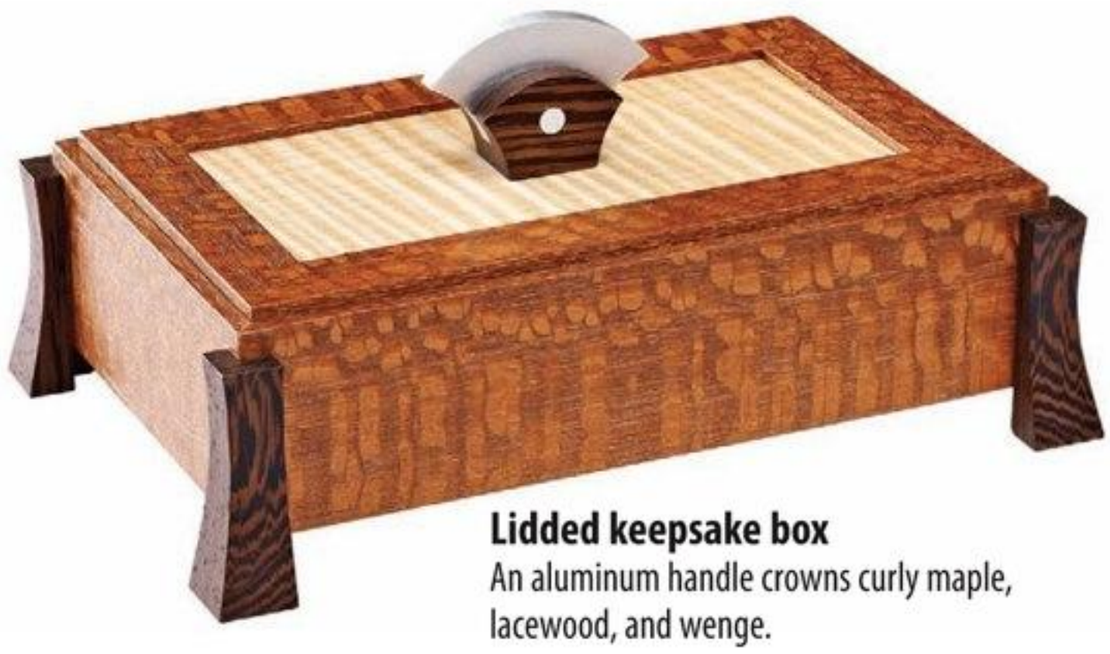


Playroom storage
Here's a toy box handsome enough that you can convert it to holding blankets after the kids grow up. Screw-together joinery makes it a snap to build.

Collector's glass-top display table
Four identical sides make this showpiece surprisingly simple to build. The top lifts off for easy access to the felt-lined display well.



Lidded keepsake box
An aluminum handle crowns curly maple, lacewood, and wenge.

The whole story on sliders
Find our hands-on shop tests of today's top-selling 10" sliding compound mitersaws. Then learn top tricks for getting maximum accuracy from your machine and how to cut precise half-lap joinery with one.

Gumball machine
Sweet! Feed your need for a weekend gift project by building this dispenser. Slide in the handle to treat yourself to a reward.

Next year's innovative tools
We've uncovered the tools and accessories that will shake up the woodworking world in the year ahead.

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